FLIGHT
The AIRCRAFT ENGINEER & AIRSHIPS

First Aeronautical Weekly in the World. Founded January, 1909

Founder and Editor : STANLEY SPOONER

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport

OFFICIAL ORGAN OF THE ROYAL AERO CLUB OF THE UNITED KINGDOM

No. 1014. (No. 22. Vol. XX.) MAY 31, 1928 [Weekly, Price 6d. Post free, 7d.

Flight

The Aircraft Engineer and Airships

Editorial Offices: 36, GREAT QUEEN STREET, KINGSWAY, W.C.2.
Telephone : Holborn 3211. Telegrams : Truditur, Westcent. London.

Annual Subscription Rates, Post Free.
United Kingdom .. 30*s.* 4*d.* Abroad .. .. 33*s.* 0*d.**
* *Foreign subscriptions must be remitted in British currency.*

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June 9 Royal Tournament, Olympia
June 3-9 R.A.F. Rifle Association Prize Meeting
June 7 .... 7th Annual Middle East Dinner
June 8 .... Banquet to Mr. A. V. Roe at Savoy Hotel
June 9 .... Light 'Plane Meeting, Castle Bromwich
June 9-10 Aero Golfing Soc.—Team Match v. R.A.F.
June 20 .... Aero Golfing Soc.—Team Match v. Porters Park G.C.
June 26-29 F.A.I. Annual Conference, Brussels
June 29—
July 15 Paris Aeronautical Salon

EDITORIAL COMMENT

TODAY, May 31, 1928, at 12.30 p.m., should prove a red letter day in the history of British Empire aviation, for on that day and at that time Sir Alan and Lady Cobham are scheduled to alight at Plymouth after completing their "Circuit of Africa" in the Short "Singapore" flying-boat with Rolls-Royce "Condor" engines. Sir Alan has established a reputation for "delivering the goods," and there is little reason to doubt that at 12.30 or thereabout the "Singapore" will touch home waters again after a flight of some 20,000 miles.

20,000 Miles

It was on November 17 last year that this machine left the Medway at Rochester, where she had been built at the works of Short Brothers, and departed on the first stage of her long flight. Since that date the "Singapore" has taken off and alighted something like 80 times, thus, as Sir Alan expresses it, providing 160 chances of something going wrong. The great point, to our way of thinking, is that nothing *has* gone wrong with the machine during all those starts and alightings. The damage caused to the "Singapore" at Malta, which resulted in a long delay, happened while the machine was moored or being transferred from one mooring to another, and was in no wise due to any shortcomings on the part of the flying-boat.

Probably it is not generally realised how truly Sir Alan speaks when he refers to those 160 opportunities for mishaps. It should be recollected that in nearly all cases the take-offs and alightings were on unknown waters—unknown that is as far as flying-boat operation was concerned. It should be realised that, while a flying-boat is travelling along the water at high speed while taking off, or is just settling down on the water at fairly high speed, it requires but a very small object in the water to cause damage to the hull. A submerged piece of wood may on occasion be sufficient. Something of the sort actually happened to the "Singapore" while on test at Rochester, but thanks to the all-metal construction it was possible to effect repairs in a day, and the machine was able to leave on time.

We have no exact knowledge as to whether any such troubles did occur during the great flight, but if so, they were obviously not of a serious nature, and could be set right on the spot with the facilities available. The Rolls-Royce "Condor" engines also have proved themselves equal to the task. That it was by no means an easy one will be realised when it is remembered that the Equator was crossed twice, and that consequently during long portions of the flight the engines were working in a very high temperature.

From the technical point of view, Sir Alan Cobham and those associated with him in the Sir Charles Wakefield Flight of Survey around Africa may be said to have definitely proved the suitability of the flying-boat for Empire air communications. Never before in the history of flying has a British flying-boat accomplished a flight of this nature and extent, and we have cause to be well pleased with the results. The idea of continuing the flight to various seaports around our coasts is, to our way of thinking, a very happy one. It is most important that the shipping world should become interested in aviation, and more particularly in the seaplane, as the day must come when close co-operation between seafaring and airfaring people will become a necessity. It would be difficult to imagine anything better calculated to demonstrate to the shipping world that the flying boat is now a practical proposition than such a tour by a machine which has already completed more than 20,000 miles in all manner of climates and under all sorts of sea conditions.

Details are not yet available concerning the routes and possibilities on which Sir Alan has reported to the various authorities, but it is known that he was impressed by the excellent opportunities for establishing air lines in Africa, thus bringing the various territories nearer to one another. That the people themselves are fully alive to the benefits which aviation has to offer British Africa is shown by the speech of Dr. Samuel Evans, Chairman and Managing Director of Crown Mines, Limited, at the annual meeting of that company at Johannesburg.

"I am confident," Dr. Evans said, "that the time is not far distant when consulting engineers will visit outlying mines by air, and when parts of machinery or other things urgently required by such mines will be dispatched by air. Just consider for a moment what an air service would mean to a mine like the Shamva. By surface transport, it takes five days for the output of that mine to reach the Rand Refinery at Germiston. By air it would not take more than seven or eight hours. The advent of safe and reliable air transport is going to be helpful not only to the gold-mining industry, but to many other industries. Indeed, it is going to give a revolutionary impetus to the development of the mineral and other resources of those parts of Africa and of the world which have lain more or less dormant owing to their inaccessibility. 'Darkest Africa' has remained 'Darkest Africa' mainly owing to the absence of transport facilities."

Dr. Evans then continued: "In my view, the one thing that is holding back aviation and other similar enterprises in countries under the British flag in Africa at present, is the anti-capitalistic taxation policy of the British Government and of the Union Government, introduced largely since the end of the Great War . . . If some of the enterprising capitalists who are financing air ventures in South America and other tax-exempt countries did the same in the Union of South Africa, their investments would have to earn about double the amount of distributable profit in order to give them a net dividend equal to that which they get in tax-exempt countries like the Argentine."

The conclusions one may draw, therefore, appear to be that, technically, aviation is able to supply the needs of the country; the people themselves realise this, and are willing to go ahead, but are held back by the Government's insane taxation policy. We of the aviation world cannot remedy this state of affairs, which must be taken in hand by the Governments. Doubtless, Sir Alan Cobham's report will assist materially in bringing conviction of the necessity for Government assistance in making a start.

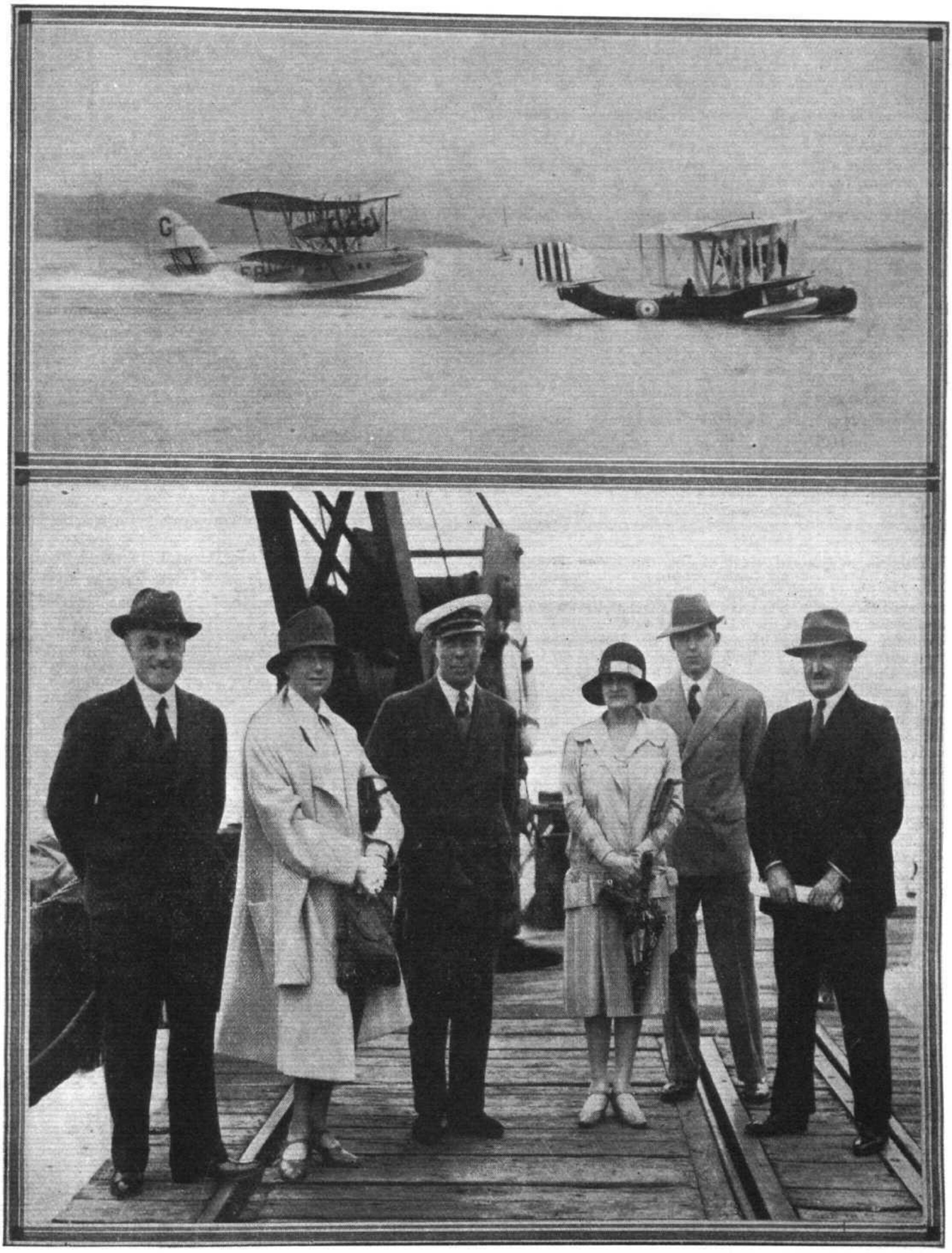
THE ROYAL TOURNAMENT

AT Olympia this glorious annual event is now in full stride, daily at 2.30 p.m. and 8 p.m., and it is good to note that it is a case of a "full house" at every performance, which is hardly surprising, having regard to the surfeit of value placed before each and every assembled audience. One would think that it would be difficult, if not impossible, to improve upon previous years' shows, but every item in the present programme is so remarkably excellent that our personal view suggests all previous efforts have been surpassed. Never for one moment is interest allowed to flag—one event following the other with record speed, each to be received with appreciation expressed in deafening applause.

Probably the most exciting item is the wonderful Royal Naval and Royal Marines Inter-Port Field Gun Competition, which once again holds a place of honour. A mounted display by Weedon Equitation School calls for admiration as showing the perfection to which training can be brought, and an understanding between man and beast. To us the Display of Physical Training by 192 members of the Royal Air Force was, as before, an item particularly attractive. As the "troop" marched into the arena in their white and blue, youth was exemplified at its zenith. To the time of their own band, their movements throughout were carried out with the precision of the most perfect machine. With arms or legs in motion, together or separately, mostly in novel and unique exercises, the entire personnel went through their evolutions in such manner as to suggest a joyous delight in their work—in fact, so breezy are some of their "set pieces" as to excite the envy of the most expert jazzers. The finale of this turn is alone worth a visit to Olympia, when at the pipe of a whistle the men, in what appears to be a momentary scramble, in a few seconds form a human "R.A.F.," with "centre piece" topped by the R.A.F. colours. Altogether, a wonderful piece of drilling.

Beyond the items already mentioned, there is almost a surfeit of good things to follow, including a Musical Drive by "M" Battery, R.H.A., Guards' Depot recruits drill, R.A.S.C. riding and driving display, Royal Scots Greys (and Dragoons) Musical Ride, Trick Riding by the 17th/21st Lancers, Army Physical Training Staff gymnastic display, the remarkably clever and amusing display by the boys from the Duke of York's Royal Military School, and last, but not least, the stirring and imposing historical display by the Royal Scots Fusiliers. The Service Charities ought, this year, to benefit even to a greater extent than in previous years, when, owing to the appreciation and support of a magnificent show by the public, have proved, year by year, more successful. The Display closes finally on Saturday, June 9.

FLIGHT



["FLIGHT" *Photograph*

AIR MINISTER'S CHANNEL CRUISE : This week Sir Samuel Hoare is making a cruise of inspection to the Channel Islands, Scilly Islands, &c., in one of the new Short all-metal "Calcutta" flying boats with "Jupiter" engines. He is here seen with Lady Maud Hoare (who is accompanying her husband on the flight), Wing Commander Louis Greig, Lady Higgins, Mr. Geoffrey Lloyd, Private Secretary to Sir Samuel and Conservative candidate for Ladywood (now held by Mr. Neville Chamberlain) and Sir John Higgins, Air Member for Supply and Research. Above, the "Calcutta" is seen at the moment of departure, while in the foreground is the Supermarine "Southampton"-Napier which is escorting the Air Minister on his cruise.

HAMPSHIRE AIR PAGEANT

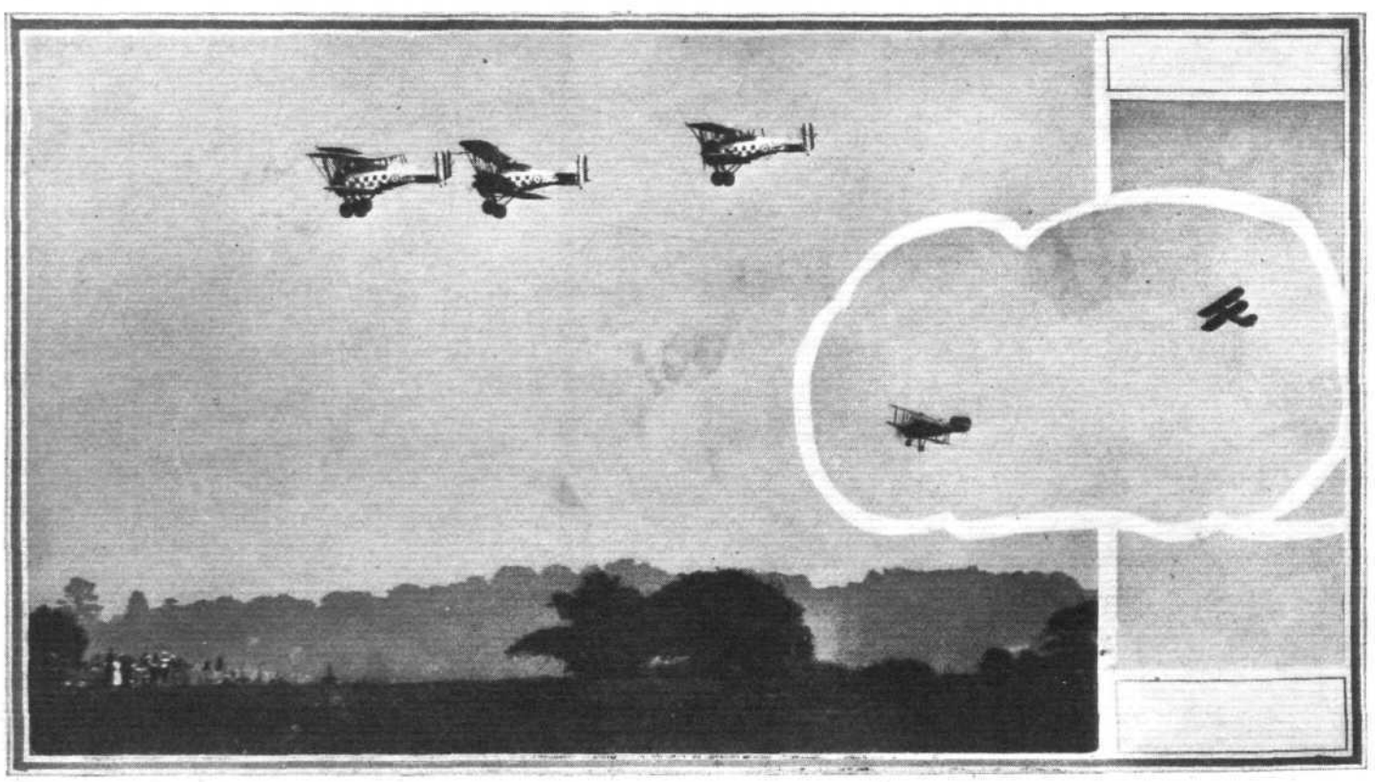
BENEATH a remote blue sky and in the white blaze of a burning sun a huge crowd gathered at Hamble for the attractive Whitsun programme organised by the Hampshire Aeroplane Club with every efficiency and effectiveness. The crowd, aircraft and cars described three long curves round the field and when the machines massed in the air there were sufficient to make a menacing air raid. Loud speakers ranged the enclosures and broadcast pleasant music when the clear voice of the announcer was not enlightening the spectators with the course of events. A row of refreshment tents played an adequate and necessary part in the programme, and Senor Juan de la Cierva provided an unintentional thrill by bringing his fascinating Autogiro to gentle grief in the prominent centre of the field, where it remained on the side of its nose like a large wounded bird for the rest of the day. It was a trivial affair for which he took entire blame.

On the Sunday most of the visiting machines arrived, and in the afternoon the preliminary heats of the three important races were held with the following results :—

Wakefield Light Aeroplane Handicap.—The first heat in this race for light aeroplanes with an engine of less than 5,000 c.c. over four laps of the course equalling 22 miles, was won by Mr. Alan Butler on D.H. " Moth X " (Cirrus) "UX" at 95 m.p.h., with a handicap time of 14 mins. 6 secs. Second heat winner, Flight-Lieut. Le Poer Trench on the H.A.C.2 (Cherub) "OO" at 79½ m.p.h. (handicap time, 13 mins. 3⅕ secs.). Third heat winner, Mr. G. E. Lowdell on Blackburn " Bluebird " (Genet) " SZ " at 85¼ m.p.h. (handicap time, 12 mins. 42 secs.). Fourth heat winner, Flight-Lieut. F. O. Soden on D.H. " Moth " (Genet) " OU " at 94½ m.p.h. (handicap time, 12 mins. 21⅗ secs.).

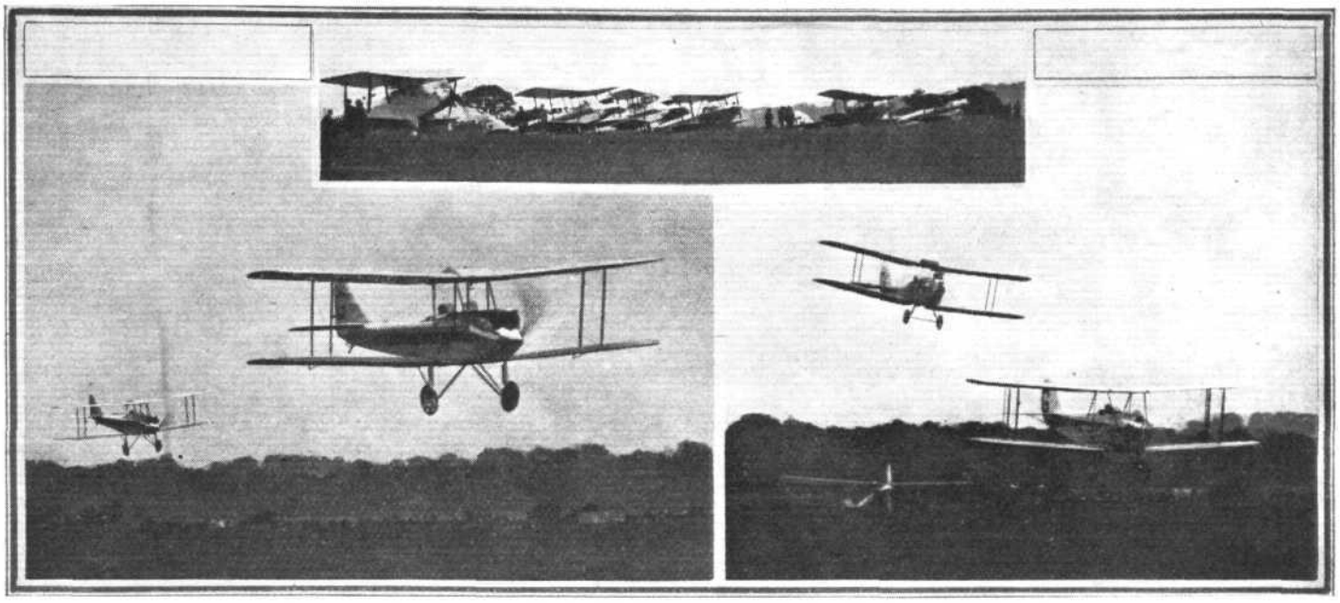
This is a general view of the machines grouped round the enclosures with the Parnall " Imp " in the foreground.

President's Cup Race.—This was for machines of not more than 100 h.p. flown by a member of any British Aero Club. First heat winner was Flight-Lieut. Bonham-Carter on the Parnall " Imp " (Genet) " TE " at 97½ m.p.h. (handicap time, 13 mins. 45 secs.). Second heat winner, Flight-Lieut. F. O. Soden on " OU " at 95 m.p.h. (handicap time, 12 mins. 28 secs.). Third heat winner, Flight-Lieut. N. Comper on C.L.A.4 (Cherub) " PB " at 79 m.p.h. Fourth heat wiiner, Flight-Lieut. Chick on Blackburn " Bluebird " (Genet) " UH " at 83½ m.p.h. (handicap time, 12 mins. 25 secs.). Fifth heat winner, Flight-Lieut. T. B. Bruce on



["FLIGHT" *Photograph*

HAMPSHIRE AIR PAGEANT : The four R.A.F. Gloster " Gamecocks " flying in formation during their exhibition of drill at the Pageant, flown by Sqdr.-Ldr. C. N. Lowe, Flt.-Lieut. A. C. Collier, and Flying Officers N. A. P. Pritchett and H. C. O. Hayter. Inset shows the Avro " Bison " descending after being defeated by the (distant) Fairey " Flycatcher " in the aerial combat.

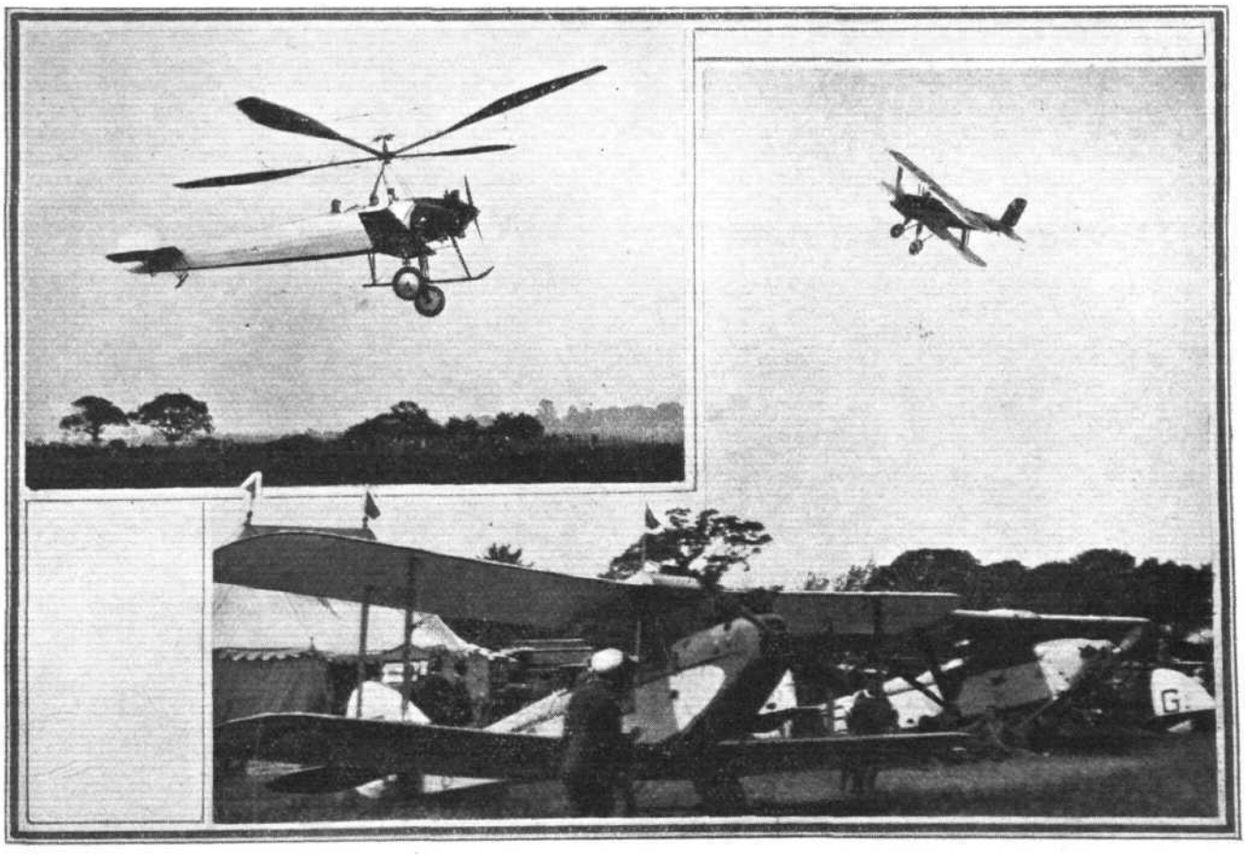


AT HAMBLE : In the top picture are the machines lined up for the important Morris Open Handicap, and the nearest machine is Capt. Stack's Martinsyde-Nimbus, which won it at a speed of 129¾ m.p.h. On the left, are the two Avro "Avians," flown by Flt.-Lieut. Luxmoore and Capt. H. A. Brown, fighting their duel in the same race, with the former on "XY" leading. On the right, Mr. Lowdell on the Blackburn "Bluebird" "SZ" is seen leading Flt.-Lieut. Rose on the D.H. "Moth" "LW".

Avro "Avian" (Cirrus) "QN" at 100 m.p.h. (handicap time, 12 mins. 26 secs.).

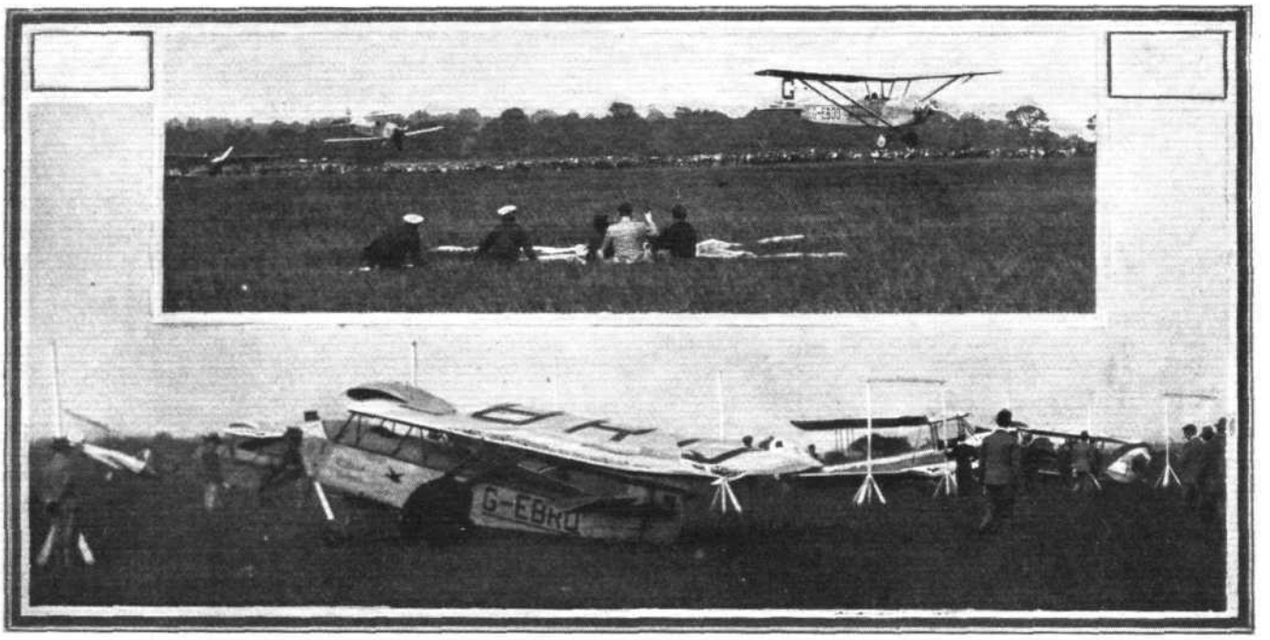
Morris Open Handicap.—This race was open to all comers. First heat went to Lowdell on "SZ" at 87½ m.p.h. (handicap time, 12 mins. 38 secs.). Second heat to Capt. N. Stack on the Martinsyde-Nimbus "OJ" at 134½ m.p.h. (handicap time, 11 mins. 56 secs.). Third heat was won by Flight-Lieut. Luxmoore on Avro "Avian" (Cirrus) "XY" at 91½ m.p.h. (handicap time, 13 mins. 7 secs.). Fourth heat went to Flight-Lieut. T. Rose on D.H. "Moth" (Cirrus) "LW" at 84 m.p.h. (handicap time, 12 mins. 48 secs.). The fifth heat was won by Capt. H. A. Brown on Avro "Avian" (Cirrus) "XX" at 93½ m.p.h. (handicap time, 12 mins. 47 secs.).

On Monday, the events started at 2.15 p.m. with a parade and fly past. In the morning there had been plenty of flying, including joy-riding and an interesting spectacle of massed flying with the Imperial Airways air liner leading. It was just before the parade after lunch that Senor de la Cierva returned to the aerodrome in his "Autogiro" (Lynx) with



["FLIGHT" *Photographs*

Senor de la Cierva flying his Autogiro above the crowd with a passenger in the rear cockpit. It was fitted with an Armstrong-Siddeley "Lynx," and attracted its usual delight amongst the public. In the other picture is the fast single-seater Avro "Avenger," which tore along the enclosures and then zoomed, piloted by Flt.-Lieut. Luxmoore.



WAKEFIELD HANDICAP : Flt.-Lieut. Le Poer Trench on the Halton monoplane " OO," leading Flt.-Lieut Soden on his D.H. " Moth " (Genet) " OU " in the second lap of the race, which was eventually won by the former at 80½ m.p.h. On the right shows the machines being wheeled between the posts at the end of the Utility Race.

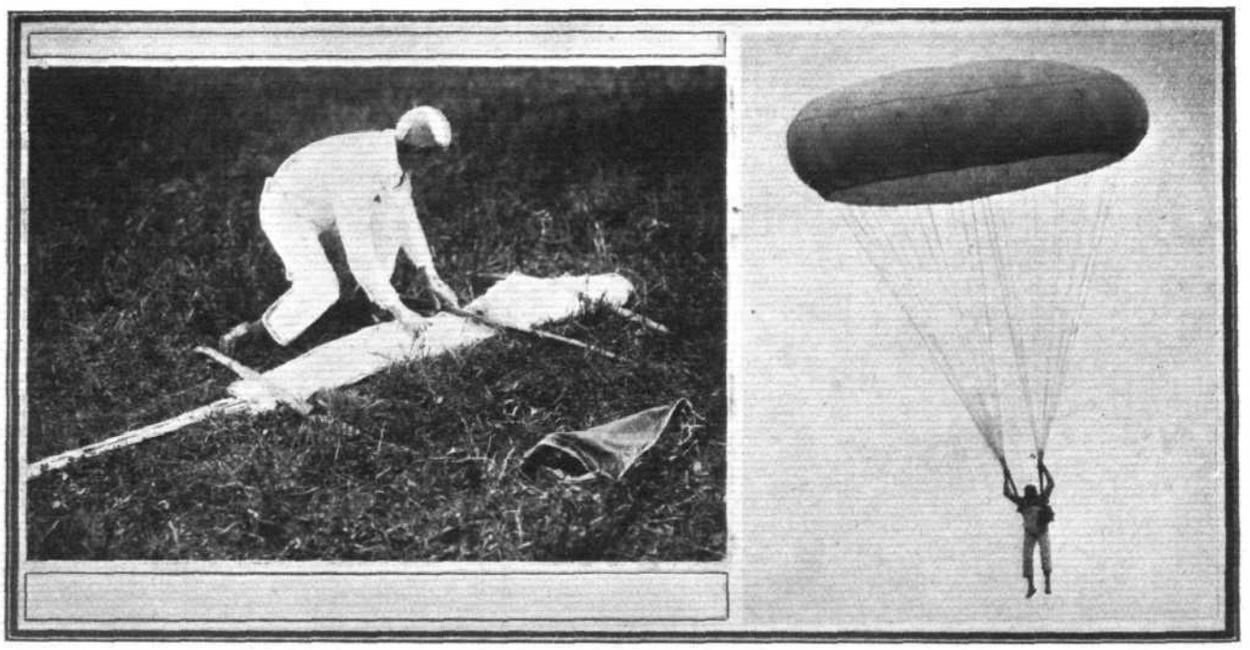
Mr. Art Fowler, the ukelele expert, as passenger. He gave an exhibition above the crowd and then landed vertically at a speed that seemed rather fast. It resulted in a heavy bump and the chassis collapsed, tilting the machine on the port side of the nose where it stuck, tail in the air, with the wind vanes still revolving and looking at the distance as though they were striking the ground. Senor de la Cierva said afterwards that he had carelessly landed side to wind slightly. Neither he nor his passenger were in the least hurt.

In the parade and fly past there was an interesting variety of aircraft from all the light aeroplane types to R.A.F. machines. The latter were Fairey " Flycatcher," Gloster " Gamecock," Avro " Gosport," Blackburn " Blackburn," Avro " Bison," and Blackburn " Dart." Each circled the field at a low altitude.

Wakefield Light Aeroplane Handicap.—The final of this race was a victory for the Halton Club. Order of starting was as follows :—Trench on " OO " (handicap allowance, 3 mins. 51 secs.) ; Lowdell on " SX " (1 mins. 28 secs.) ; Soden on " OU " (1 mins. 08 secs.) ; Lady Heath on " UG " (0·41 secs.) ; Bruce on " QN " (0·08 secs.). Butler on " UX " (scratch).

Trench nearly did his first lap of 5½ miles before Butler got away. Lowdell came along on the " Bluebird," scraping the ground, with Soden on the " Moth " hot on his tail. Lady Heath passed next on her " Avian," with Bruce on his " Avian " hard after her, and Butler following up well on his " Moth."

As they passed on the far side of the aerodrome in the course of the second lap Lowdell and Soden were neck and neck along the ground on the tilt. The Halton monoplane still held its lead on this second lap and passed along plodding gamely, but the two tusslers had slightly reversed their position, Soden now leading Lowdell. Lady Heath, too, had had to give way to Bruce who was creeping up on the former pair. The scratch man, Butler, was also improving his position. In the third lap there were further changes. Trench maintained his lead, but Soden came scraping the ground without his rival, Lowdell, this time, who had dropped back behind Bruce. The latter was well after Soden.



["FLIGHT" *Photographs*

Mr. John Tranum folding his Russell " Lobe " Parachute on the ground and then descending straight after leaping from Mr. J. Carberry's D.H. " Moth " at 2,000 ft.

Lady Heath found Butler very formidable this lap, and when the pair appeared across the aerodrome going on the fourth lap she was behind him. Again, when the machines appeared on the fourth lap, the order was Trench, Soden and Bruce, but all much closer, and one began to wonder whether the plucky little Halton monoplane would stay the pace for the final lap. Lowdell had fallen back considerably, and Butler was well after him, leaving Lady Heath last. The finish was anticipated with enthusiasm and doubt. Trench and Soden on Halton monoplane and Genet-Moth respectively fought a close end and Trench won. Someone mentioned that his victory would pay for the alterations made to the Halton boys' machine. It was a very popular success. His handicap time was 17 mins. $8\frac{3}{5}$ secs. and speed $80\frac{1}{2}$ m.p.h. Soden's time was 17 mins. $9\frac{2}{5}$ secs. and speed $95\frac{1}{2}$ m.p.h. Bruce finished third on the "Avian" after starting fifth. His time was 17 mins. 18 secs. and speed $101\frac{1}{2}$ m.p.h. The first prize was the Sir Charles Wakefield Challenge Cup (and replica), and £30. Second prize, £15. The last holders of the cup were the London Aeroplane Club (Mr. L. J. C. Mitchell). Course was 22 miles.

Light Aeroplane Utility Race.—All competitors in this event had to be *ab initio* members of the entering club. After one flight of the course each had to fold his machine and house it between the posts, representing the sides of a shed, with the help of the passenger. Mr. Craig set off first on the London Aeroplane Club's yellow D.H. "Moth" (Cirrus), "MP," and he was followed by Miss Spooner on her own D.H. "Moth" (Cirrus) "OT," Capt. Kirby, of the home club, on Avro "Avian" (Cirrus) "VI," Mr. Cazalet on his Westland "Widgeon" (Cirrus) "RM," and Flying Officer Penrose on the Westland "Widgeon" (Cirrus) "RQ" as scratch. The respective handicap allowances were 52 secs., 32 secs., 15 secs., 10 secs. This handicapping produced a most interesting finish. Craig came in first, but he was soon followed by all the others, who landed in a bunch too near the posts and were unable to pull up or able to deviate, with the result they collided with the posts and created a humorous confusion. The posts were quickly restored, and the competitors hastened to fold their machines and wheel them in.

From the distance the two "Widgeons" seemed very quickly in place, but the result revealed a wholesale disqualification. Mr. Cazalet proved to be winner and Mr. Craig second. Mr. Penrose was apparently disqualified because his wings touched the posts when he was wheeling into position. Miss Spooner unfortunately suffered slight damage to her "Moth," mostly along the leading edge of the bottom wing. One or two nose ribs and a section of the leading edge looked crushed. First prize was a "Stormograph," presented by Messrs. Short and Mason, Ltd., and the second prize was £10. Both winners qualified for the S.B.A.C. inter-Club Challenge Cup.

President's Cup Race.—Those who had qualified for the final of this event were Flight-Lieut. N. Comper on the

["FLIGHT" *Photograph*

Mr. A. V. Roe chatting with Sir Sefton Brancker (—moustache) in the field, where both acted as stewards during the events.

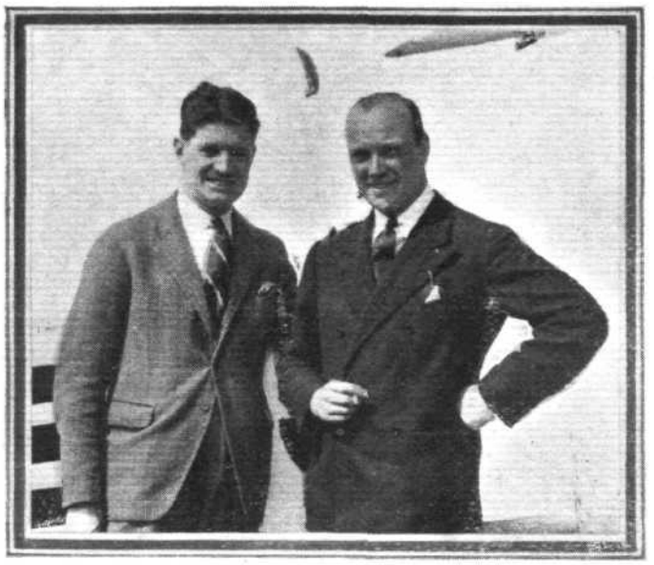
["FLIGHT" *Photograph*

Commander H. Scott Paine, Lady Heath, Brigadier-General P. R. C. Groves, and little Miss Pat Roe at the Pageant.

["FLIGHT" *Photograph*

TWO "IMPS": On the right is Mr. Bolas, designer of the Parnall "Imp" which won the Balloon Bursting Competition. With him is Flt.-Lieut. Bonham Carter, who flew it.

C.L.A.2 "PB" (handicap allowance 3 mins. 22 secs.), Flight-Lieut. R. S. Chick on Blackburn "Bluebird" "UH" (2 mins. 53 secs.), Mr. G. E. Lowdell on Blackburn "Bluebird" "SZ" (2 mins. 04 secs.), Flight-Lieut. F. O. Soden on D.H. "Moth" "OU" (1 min. 02 secs.), Flight-Lieut.



CELEBRITIES AT HAMBLE : On the left is Flt.-Lieut. O. E. Worsley, who was a member of the last R.A.F. Schneider Trophy Team, and with him is Capt. N. Stack, who carried off the Morris Open Handicap in first-class style on the Martinsyde-Nimbus at a speed 129¾ m.p.h.

Bonham Carter on Parnall "Imp" "TE" (0·16 secs.), and Flight-Lieut. T. B. Bruce on Avro "Avian" "QN" (0·08 secs.). It was won fairly easily by Bruce at 102¾ m.p.h. (handicap time 16 mins. 40 secs.). Soden was second with a speed of 96 m.p.h. (handicap time 16 mins. 44 secs.). Lowdell obtained third position at 89 m.p.h. (handicap time 16 mins. 49 secs.). Chick made a forced landing during this race, but he returned some time after, and Comper was apparently outclassed, for he gave up. The course was 22 miles. The first prize was the President's Challenge Cup (with replica) presented by the Rt. Hon. Lord Louis Mountbatten, and £30. The second prize was £15. Halton Aero Club were the last holders.

Morris Open Handicap.—Competitors in this event started in the following order :—Flight-Lieut. Swoffer on D.H. "Moth" (Cirrus) "OI" (handicap allowance 7 mins. 0·02 secs.) ; Flight-Lieut. Rose on D.H. "Moth" "LW" (handicap allowance 6 mins. 50 secs.) ; Mr. Lowdell on the Blackburn "Bluebird" "SZ" (6 mins. ·01 secs.) ; Capt. Brown on Avro "Avian" "XX" (4 mins. 54 secs.), and Flight-Lieut. Luxmoore on Avro "Avian" "XY" (4 mins. 54 secs.) ; and Capt. N. Stack was scratch on his Martinsyde-Nimbus "OJ."

After the first lap Swoffer was maintaining his lead and Rose and Lowdell were in the order they had left. Brown and Luxmoore, who started together, were having an interesting duel some distance behind with the former slightly ahead. After these four had finished this first lap Stack started. In the second lap Swoffer and Rose were still first and second respectively with the latter creeping up. Lowdell came along some distance behind, followed by Brown and Luxmoore still clinging together, whilst Stack shot past on a slight angle striving well to overcome his handicap.

There was a change of order in the third lap. Rose was leading Swoffer, but otherwise Lowdell, Brown and Luxmoore and Stack came along as before, although the latter was clearly beginning to close up the long gap. On the fourth lap Rose maintained his lead, but this time he was being challenged strongly by Lowdell, whilst Swoffer was third, followed by Brown and Luxmoore as before, and Stack nearer than ever and obviously with a firm hold on the others. All passed the aerodrome comparatively close together. As they appeared on the far side of the aerodrome heading on the last lap Stack shot past three competitors, who would be Brown, Luxmoore and either Lowdell or Rose, probably the latter. At the finish, as expected, Stack flew home first well ahead with Lowdell's "Bluebird" second and Rose on the "Moth" third. Their respective speeds and handicap times were (1) 129¾ m.p.h. (20 mins. 14 secs.) ; (2) 88 m.p.h. (20 mins. 26 secs.) ; (3) 84½ m.p.h. (20 mins. 26⅕ secs.).

The course was 27½ miles, and the first prize the Morris Challenge Cup (with replica), presented by Mr. W. R. Morris, and £50. Second prize, £20. The last holder was Mr. H. B. Youell.

Balloon Bursting Competition.—This event attracted six competitors and particularly delighted the crowd. The attempts were made in the following order :—Mr. Dobson, on Avro "Avian" "XX" ; Mr. Cazalet, on Westland "Widgeon" "RM" ; Mr. Bartlett, on D.H. "Moth" "TV" ; Flight-Lieut. Bonham Carter, on Parnall "Imp" "TE" ; Flight-Lieut. Bruce, on Avro "Avian" "QN" ; and Flight-Lieut. Luxmoore, on Avro "Avian" "XY." Mr. Dobson could not reach his bunch of ten balloons at all. He circled continuously in vain and gave the impression that the feat was difficult. Mr. Cazalet quickly dispelled this idea,

["FLIGHT" *Photographs*

HAMBLE : The Suffolk Aeroplane Club group. Starting second from right they are Mr. Courtney N. Prentice, Mr. G. E. Lowdell (Instructor), Miss S. Edwards (seated), Mr. J. R. Hillair Brady, Mrs. C. Prentice, Mr. and Mrs. Billinton, Capt. Blake, and Mr. Verney. On the ground are Mrs. Holmes, Major Holmes, and F/O L. S. Birt.

["FLIGHT" *Photograph*

Seeking the shelter of the wing from the sun are (left to right) Mr. Newington, Mr. F. Sigrist, Mrs. Sigrist, Mrs. Hawker, Miss Alleson, Mrs. Newington and Mr. Leach.

however. He wisely attacked before his balloons rose very far off the aerodrome, and he dived again and again at the scattered ones. Mr. Bartlett also showed immediate aptitude with his bunch, scoring before they were aloft almost, and then attacking with low climbing turns as they separated. Flight-Lieut. Bonham-Carter did even better by destroying his batch at his first attack. Flight-Lieut. Bruce was also good, and Flight-Lieut. Luxmoore won himself second place in the event to Flight-Lieut. Bonham-Carter's first. The prize was £10 for the winner, and each competitor was given three minutes.

R.A.F. Display.—A most important part in the day's programme was played by the R.A.F. There was an exhibition of Gloster "Gamecocks," piloted by Sqdn.-Ldr. C. N. Lowe, Flying-Officers N. A. P. Pritchett and H. C. O. Hayter, and Flight-Lieut. A. C. Collier. They flew over the aerodrome in various formations and drilled, then co-operated with a formation of two Blackburn "Dart" torpedo' planes led by a Blackburn "Blackburn," piloted by Flying-Officer L. H. Brooke. Flight-Lieut. C. B. Riddle and Flying-Officer Thompson flew the "Darts," each of which carried a bright red-nosed torpedo beneath the fuselage. The groups were flown together to emphasise their difference in relative performance, which was clearly apparent.

Flight-Lieut. Rawson gave an interesting demonstration of various stunts in the Avro "Gosport" training machine, including inverted flight, slow rolls and loops from the inverted position.

Flight-Lieut. A. C. Collier did similarly in a Gloster "Gamecock," and brought his machine at close quarters to the enclosures and gave the public an intimate but safe view of the "Gamecock" in flight.

Formation flying by a flight of "Gamecocks" was given efficiently by Flight-Lieut. A. C. Collier and Flying-Officers N. A. P. Pritchett and H. C. O. Hayter, of No. 43 Squadron, R.A.F., Tangmere. Their manœuvres synchronised perfectly, and included loops and the movement describing the Prince of Wales feathers.

A Fairey "Flycatcher," piloted by Flying-Officer F. C. Jennings, engaged in combat with an Avro "Bison," flown by Flight-Lieut. J. S. Harrison, and in due time it forced the "enemy" to descend in "flames," whilst the dummy crew escaped by parachute. Two large brilliant yellow lights trailed beneath the bottom wings of the "Bison," with two trails of smoke to represent fire, and it descended like the falling leaf. One of the dummy crew fell into high trees beyond the aerodrome, and the parachute sprawled on the side branches, whilst the other member of the crew disappeared beyond the trees altogether.

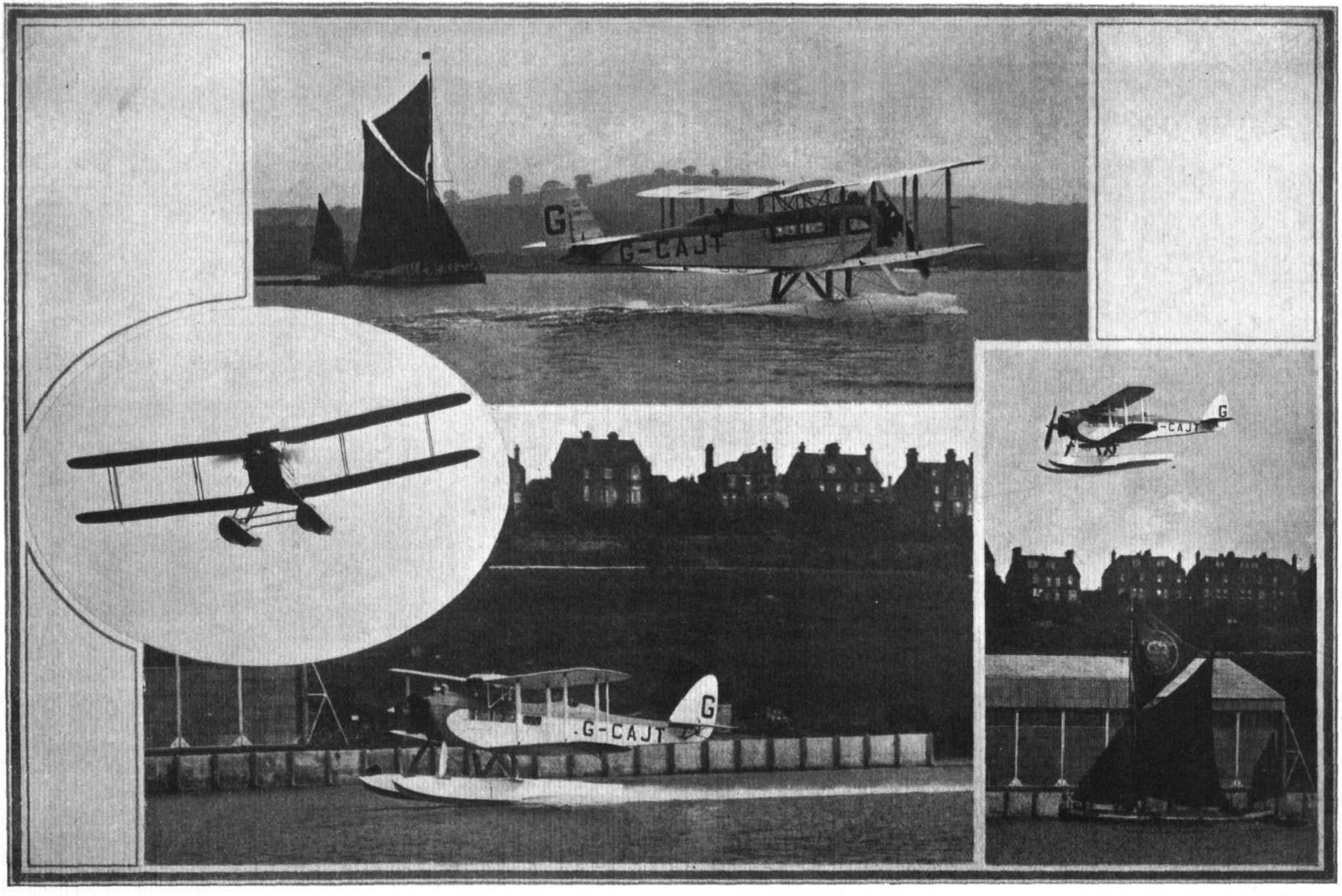
A thrilling item was a ground strafe by Gloster "Gamecocks," flown by Sqdn.-Ldr. Lowe, Flying-Officers N. A. P. Pritchett and H. C. O. Hayter, and Flight-Lieut. A. C. Collier. They appeared over the aerodrome in formation and surprised an hostile machine (a derelict Avro) in enemy territory, which they proceeded to bomb after parting. Diving on it steeply in turns from all angles, they released small objects which burst into white smoke on contact and quickly enveloped the machine in a thick cloud.

Perhaps the R.A.F. item which most thrilled the crowd was the performance of Flight-Lieut. F. L. Luxmoore on the fast single-seater fighter, the Avro "Avenger," which is fitted with the Napier "Lion" engine. In the hands of its expert pilot it tore very low and direct for the enclosures, and then zoomed high and swiftly into the blue sky. The roar of the engine transmitted itself as strong as an electric current through the crowd. It came to be expected each time of approach, and, as it were, steeled against. The effect made this event more intense than anything else during the afternoon.

It can be said that the co-operation of the Air Force at air meetings dominated by light aeroplanes is a decided fillip for the public, for with the powerful machines, the effect is more impressive and often electric. After a few hours watching light aeroplanes with appearance and performance relatively similar to the public, the difference is marked. There is a general audible cry of pleasant surprise when a fast single-seater fighter takes off or a large bomber or torpedo 'plane lunges across the aerodrome, with its load of armament and prominent Air Force crew, whose alert attitude always gives the impression that they are going into battle or, at least, have a job of work on hand. They scorn their seats, and those in open cockpits usually squat on top of the gun ring. Their prominence in the large machines also suggests that they are crowded out.

The two concluding items in the civil programme were a demonstration of the slotted wing, and a parachute jump. Capt. Broad flew a slotted wing D.H. "Moth," and Capt. H. A. Brown a slotted-wing Avro "Avian." Together they stalled at very low altitudes and gently floated before the enclosures.

Mr. John Tranum, the Russell "Lobe" parachute expert, jumped from a D.H. "Moth" piloted by Mr. J. Carberry, at a height of about 1,000 ft. He used the silk type which quickly opened, brought him down steadily and collapsed when he reached the ground. Tranum is now connected with the British Company formed to produce the Russell parachutes, and has recently returned from Sweden, where his exhibition jumps from a D.H. "Moth," flown by Mr. J. Carberry, attracted wide interest in the Press. Before his descent at Hamble, he folded the parachute on the ground in quick time. He contributed another item to the programme by climbing over Mr. Carberry's machine in flight, riding at one moment on a wheel, and on landing he was sitting on the top wing.



["FLIGHT" *Photographs*

THE DE HAVILLAND D.H. 61 AS A SEAPLANE: The first of the type, christened "Canberra" was a landplane with Bristol "Jupiter VI," and was sold to a firm in Australia. Having proved very efficient in its original form, the D.H. 61 has now been produced as a seaplane, with geared "Jupiter," and is here seen undergoing trials at Rochester, piloted by Captain Hubert Broad.

The AIRCRAFT ENGINEER

FLIGHT ENGINEERING SECTION

Edited by C. M. POULSEN

May 31, 1928

CONTENTS

EDITORIAL VIEWS

Metal construction is the main, and, in fact, the only topic discussed in this issue. The reasons for this are, in the first place, that Mr. Pollard's article is a fairly long and very interesting one, and secondly, that it was decided to print as many as possible of the summaries of British Reports and Memoranda and American National Advisory Committee Technical Reports. It was felt that although, at first glance the present issue might look a little uninteresting for lack of variety, it would make up for this by containing in one "lump" a very large number of summaries. For purposes of reference this is to be preferred to having to look through a number of issues for quite a small number of summaries.

It is unfortunately a fact that in many firms only the chief designer, and perhaps his chief assistant, get an opportunity of studying the many publications which are now issued, and it was mainly in order to assist junior designers, draughtsmen and others directly interested and who cannot afford to buy everything that is published, that we decided to publish regularly these summaries, from which it should be possible in each individual case to decide with reasonable certainty whether or not a particular publication is worth obtaining.

In the present issue Mr. Pollard deals with the subject of the assembly of metal box spars into wings, thereby necessarily referring in some detail to the question of rib design and construction, modes of attaching ribs to spars, and the construction of leading and trailing edges. Some interesting information is given concerning the stress developed by two spars of the same section, one with rib post supports like that shown in Fig. 2, and the other without such supports. The spar with the supports developed a stress of 63·6 tons per sq. in., while the spar without these supports developed a stress of 52·62 tons per sq. in. There is thus cause to assume that rib posts play a not unimportant part in giving support to the spar.

Tapered spars are generally shunned by designers as being costly to manufacture. Mr. Pollard sets out to show that this need not necessarily be the case, and proceeds to show various methods of making tapered spars. Built-up streamline struts are also dealt with, and altogether the article is a most interesting one.

METAL CONSTRUCTION DEVELOPMENT.

By H. J. POLLARD, Wh.Ex., A.F.R.Ae.S.

(*Continued from page* 25.)

Before continuing our investigations into the design of wing details, it is necessary to correct an error. In the last article, page 22, column 2, the following statement appeared :

E for steel has been taken as 12,500 ton per sq. in.

$\frac{1}{m^2} = \sigma^2$ for steel has been taken as 0·08 tons per sq. in.

The first line is not in question ; as to the second, Poissons' ratio, $\frac{1}{m}$, is defined as

$$\frac{\text{lateral strain}}{\text{longitudinal strain}}$$

which is simply a number, and the reference to tons per square inch should be deleted.

As a side issue, not affecting this point, "strains" are also numbers without designation, quality or unit.

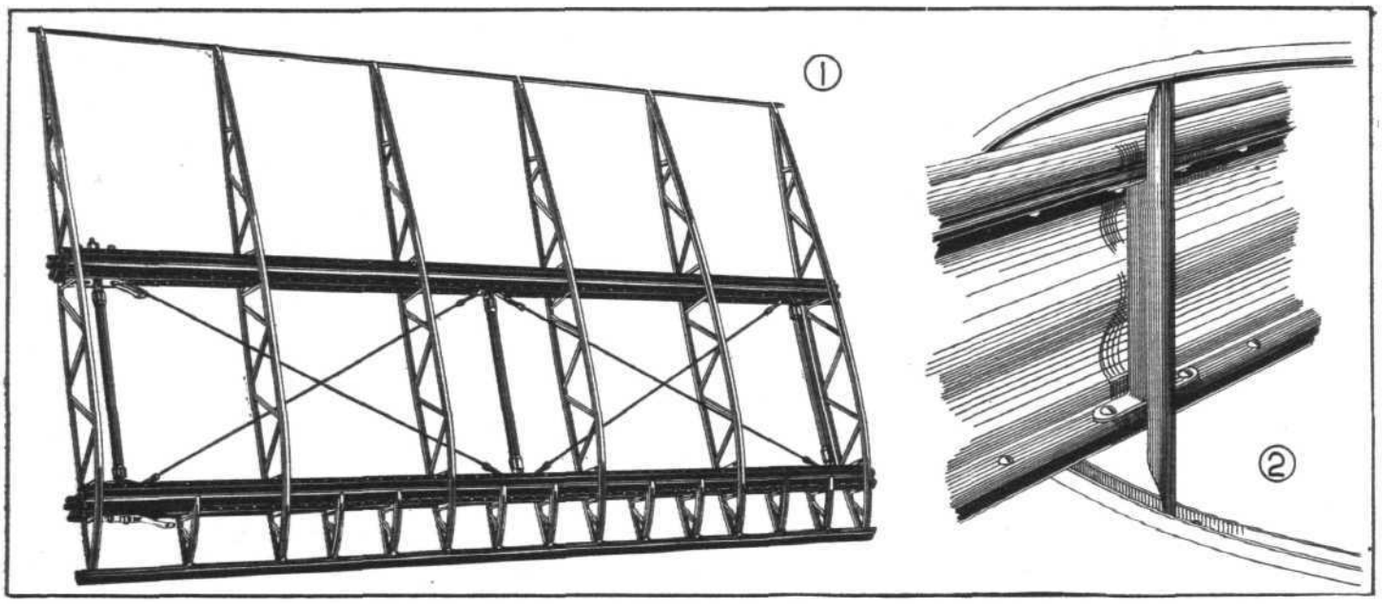
The majority of readers may think that with the large number of textbooks on the subject of materials now available there is no excuse for anyone not fully comprehending the meaning of such terms as Stress, Strain, Modulus of Rigidity, Poissons' Ratio, &c., but the writer's experience is that there is still, on simple matters, much loose talking and confused thinking which ought to be avoided.

With regard to the questions raised in March 29 Editorial Views : The tables of limits included in existing specifications for steel strip are not intended to cover strip so thin as 0·006 in. Such specifications as have been published refer to strip down to about three times the above thickness, and in these the limits for narrow strip along the centre portion are —0·0 + 0·001 in. Such a limit could not be tolerated in ribbon of thickness 0·006 in. or thereabouts. The writer thinks that when a specification covering very thin strip is published possible limits will be — 0·0 + 0·00025. This is considered possible because one prominent steel strip producer has stated that this limit is quite compatible with production at a commercial price. Experience also with such steel points in the same direction. Ribbon of different thicknesses between 0·005 in. and 0·01 in. has usually been found by the writer to be within the limits indicated.

A settlement of the question of the choice between bi-lateral and uni-lateral tolerances is obviously of fundamental importance. As the Editor infers, the adoption of a limit of 0·001 in. on 0·006 in. nominal thickness might lead to a considerably weaker structure, or alternatively, an increase in

weight; but by keeping the minus limit zero, and retaining a small positive limit, consistent with good rolling-mill practice, we are enabled to design and build steel structures from thin strip with safety and without serious increases of weight over estimates based on the nominal thickness. A uni-lateral (*i.e.* minus nothing plus something) system of tolerances makes a special appeal to the stress calculator, for he does not wish to make reference to a file of specifications to ascertain what thickness he must subtract from the standard sizes which he is accustomed to using.

punched and the rivets clinched in a very short time; if, however, the assembly is carried out by hand tools (hammers sets, etc.), the process will be long and costly. Such mediæval methods can find no place in the factory properly equipped for metal aeroplane construction. The method of assembly as shown in Fig. 3 has the great advantage of permitting rapid spar production. It cannot be said definitely at the moment that this method of wing assembly results in a saving of time in the building up of the wing as a whole. It is a question of the production of the greater number of rib pressings and the



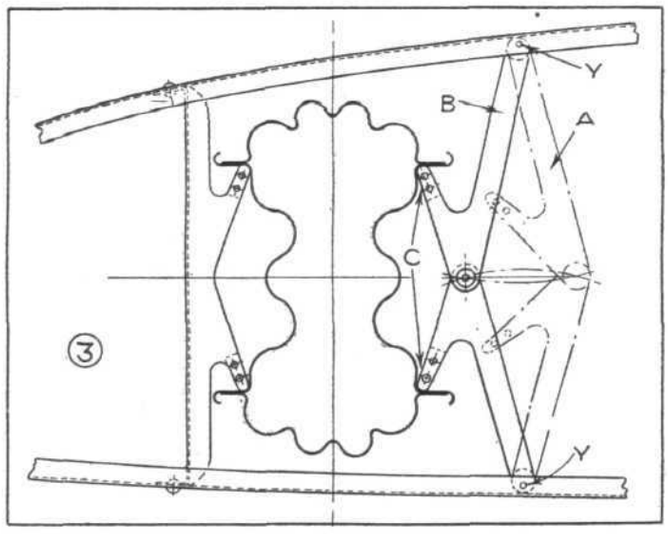
Something might be said from the workshop point of view in favour of the bi-lateral system, but we will refer to this when we deal with workshop matters. The question of corrosion will be dealt with later.

Regarding the Editor's second question, the writer thinks that this point would not have been raised had particulars regarding the frame been given more completely. It should have been stated that Fig. 1, page 14, represents one side of a tail portion of a fuselage, the total ultimate load on the tail skid of which was 1,600 lbs., that is, 800 lbs. per side. It was, however, stated later in the article (page 16) that Fig. 1 was a uni-planar structure. Presumably there would be two such plane frames each carrying 800 lbs., and they would be suitably braced together to make the complete fuselage.

A few observations on the assembly into wings of box type spars, as illustrated in Figs. 5, 6 and 7, page 24, will indicate some important features which have a direct bearing on the question of stress development in these members.

Fig. 1 shows a portion of a two-spar wing of a normal construction; Fig. 2 shows the method of joining the ribs to the spars as used in the majority of "Bristol" metal aeroplanes; Fig. 3 shows an alternative method not so extensively used. The first method needs no description: a single pressed abutment is secured to both riveted edges, that is, each rib is secured to the two spars by four such posts. The second method may need a little explanation: the rib is held in place by springing the toggle post from the dotted position A to position B and engagement is retained with the spars by virtue of the resilience of portions of the booms. The movable posts rotate about Y, Y, in which position the projections C come into contact with the spar lips. Thus, the ribs are threaded on to the spars with the toggles in position A; the same post acts as a toggle relative to the spar webs in each case, usually the post forward of each spar is made from a single pressed abutment, which is riveted to the base of the rib boom channel. In Fig. 4 details of a toggle post are shown clearly. There are two objections to the first method, one being that the continuous and complete automatic assembly of flanges and webs becomes impracticable; the second objection is that riveting of rib posts to rib flanges or booms must be carried out during wing assembly. The latter objection is not nearly so important as is generally supposed, for, given the correct appliances, the eight holes can be fitting of these into a rib, *versus* the punching of eight holes, inserting and clinching eight rivets, which latter, given the suitable equipment, can be carried out very expeditiously. The fact of the matter is that insufficient production experience has as yet been obtained with these methods to enable one to decide the matter finally.

It is evident that these rib posts actually give considerable support to the spar webs. The following is a comparison of two spars of section nearly identical with that shown in Fig. 1, page 23, the flange main radius being 0·45 in. instead of



0·5 in. To the sides of one spar, rib posts as in Fig. 2 were secured and the second spar had no such supports.

The constants of the sections were $I = 0{\cdot}38$; $y = 1{\cdot}98$; $A = 0{\cdot}208$; $Z = 0{\cdot}192$.

t, the thickness of the flanges and webs = 0·015 in. The method of loading was as shown in Fig. 2, page 23, and the ratio $\frac{P}{W} = 24$ (*see* page 24). The spar fitted with rib posts failed at a value of W = 435 lbs., the central deflection being 1·2 in.

In as far as a formula based on the assumption "plane sections remain plane" applies at the moment of failure, it would be true to say that the developed stress was

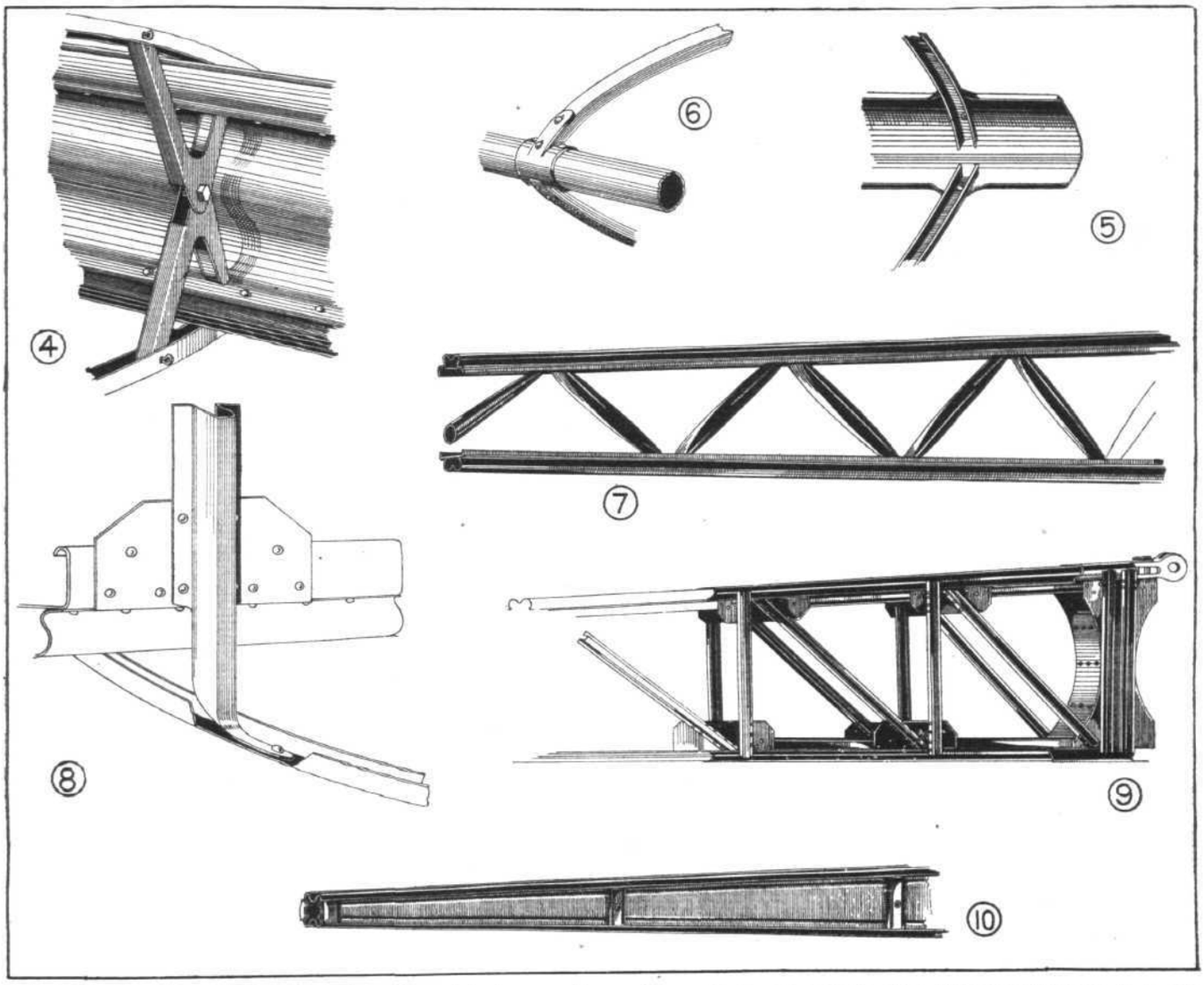
$$f = \frac{435 \times 1{\cdot}2}{2{,}240 \times 0{\cdot}192} + \frac{4{\cdot}66 \times 1{\cdot}2}{0{\cdot}192} + \frac{4{\cdot}66}{0{\cdot}208}$$
$$= \quad 12{\cdot}1 \quad + \quad 29{\cdot}1 \quad + \quad 22{\cdot}4$$
$$= 63{\cdot}6 \text{ tons/sq. in.} \ldots\ldots\ldots (1)$$

The depth of the spar did not alter appreciably during the test.

The second spar, however, failed at a load W of 380 lbs., the greatest deflection measured on the centre line of the web being 1·01 in.

The spar contracted in depth at the centre from 3·96 in. to 3·54 in.

In developing any new type of spar *all* the stresses tha may be induced by the external forces and couples should be considered. Usually only the longitudinal stresses are calculated, the shearing stresses being nearly always small by comparison; this condition has been found to be true in most of the spar types so far constructed, but it does not necessarily follow that the shearing stresses can be neglected for all types. Most stress calculators have at one time or another been incited by the light appearance of a web and the existence of large lateral forces to compute the shearing stresses along the axis of a spar. The writer cannot recall a single instance of this stress having any influence on the spar dimensions. One would, for instance, never trouble to calculate this stress in the case of the box spars described in the last article, but it should not be assumed that this case could never be of any importance.



The "developed stress" reckoned on the original moment of inertia was

$$\frac{380 \times 13{\cdot}25}{2{,}240 \times 0{\cdot}192} + \frac{9{,}120 \times 1{\cdot}01}{2{,}240 \times 0{\cdot}192} + \frac{9{,}120}{240 \times 0{\cdot}208}$$
$$= 11{\cdot}72 + 21{\cdot}4 + 19{\cdot}5 = 52{\cdot}62 \text{ tons per sq. in.} \ldots\ldots\ldots (2)$$

The moment of inertia of the central section of the spar at the instant preceding failure was 0·31 ins.⁴ approx., the Z being 0·175 ins.³. The developed stress reckoned on this latter figure was therefore

$$12{\cdot}85 + 23{\cdot}5 + 19{\cdot}5 = 55{\cdot}85 \text{ tons per sq. in.} \ldots\ldots\ldots (3)$$

An increase of about 6 per cent. over (2).

The need for accurate spar measurements being recorded as tests proceed is therefore emphasised. In this particular case the fitting of rib posts resulted in an increase of "developed stress" and load supported of about 14 per cent.

Space does not permit of a full investigation into the question of shear stresses in spars, but in the case of single web spars similar in type to Fig. 4 of the last article subjected to heavy shear loads, the maximum horizontal and vertical shear stresses can reach a very high figure if the single web is very thin. For example, in a section 4 ins. deep having a single web 2 ins. by 0·01 in., subjected to a shear force of 1 ton the maximum intensities, horizontal and vertical, of the shear stress would be of the order of 30 tons per square inch. In such a case the shearing stresses could not be neglected.

If it is considered expedient we will give this subject closer study in a later article.

The following are further items in the normal construction shown in Fig. 1. The ribs in their most elementary form consist of upper and lower booms of channel construction bent to the aerofoil shape, the aforementioned rib posts and three lengths of channel sectioned bracing per rib, one short

piece in the nose, a second length between the spars, and the third portion in the tail of the rib, the outside width of the bracings and the inside width of the booms are identical. At the panel points the sides of the bracings are folded on to the base and this folded section is riveted to the base of the channel. This construction has proved satisfactory in every way, obviously it is cheap, light and strong. Failure of the ends of the bracings by fatigue has occurred, but this trouble has been overcome without much difficulty.

Several methods of securing leading and trailing edges have been tried, but the extremely simple method shown in Fig. 5 is as good as any; special tools being available for punching the holes and clinching the rivets. The use of hammers and sets must result in a costly job. The main point concerning the method here illustrated of fastening the leading edge is that the true shape of the nose of the aerofoil is easily obtained. If special tools are made for more elaborate forms of attachment, for instance, as shown in Fig. 6, and afterwards a radical change is made in the aerofoil shape, these special tools have to be replaced at considerable cost.

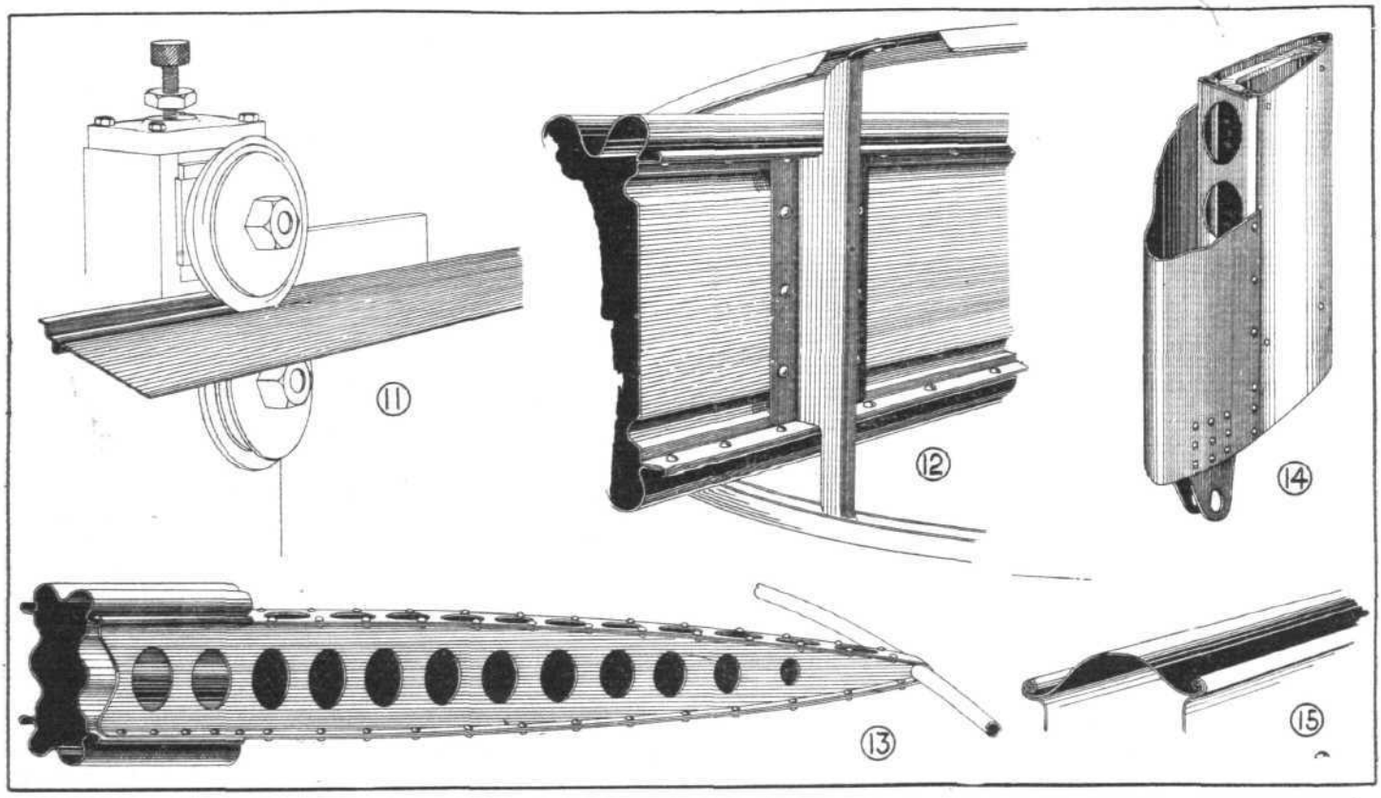
We will now consider a few special cases of spar construction as developed by the Bristol Aeroplane Company. Each of these special cases refer to tapered spars. Tapered members seem to be one of the bugbears encountered in metal construction development, but it is difficult to see why this is so.

Fig. 7 shows a metal spar designed for the Bristol "Brownie." The flanges consist of a main corrugated section, the outwardly extending flats of which are secured to a channel, the base of the channel being suitably lightened. The channel rib posts are secured to the sides of the boom channel as shown in Fig. 8. but in this case the gusset plate is not required (see below). The special feature of the construction, however, is the shear member; this consists of a single length of tube, flattened at intervals and bent up as shown, the same rivets securing the tube, channel and flange edges. The construction is identical in principle with the rib construction previously described. A second form of tapered spar is shown in Fig. 9. No very special feature is here introduced, the bracing following ordinary girder construction of the Pratt or N type, the verticals are continued above and below the flanges and the rib booms are secured to their ends exactly as shown in Fig. 8. The main booms are identical with those shown in Fig. 7, but in this case the channel side alone is insufficient for securing the bracing, and gusset plates are necessary as shown in Fig. 8. The type of end fitting best suited to these constructions is shown in Fig. 9.

The third special feature is shown in Fig. 10. The taper is obtained in this case by making the webs from flat strip, grooves being rolled along the narrowing edges, each edge being formed separately in the manner shown in Fig. 11, the extended flats in the deep portions of the web require reinforcing at intervals by internal stiffeners. Spar posts of the type shown in Fig. 12 lend additional stiffness, particularly if the edges of the centre portion of the channel are bent outwards and riveted to the flat webs.

Other methods of tapering might be described, but the above are typical cases; there appears to be no great aerodynamic advantage in having long tapers up to the wing tips, in the case of biplanes, but the saving in weight is appreciable. By cutting the wing spars short and riveting on a tapered web at each end as shown in Fig. 13 a considerable weight reduction is possible.

For example, in a normal two spar wing of say 6 ft. chord, a taper of 2 ft. 6 in. should result in a saving of weight of at least 1·5 lb. per spar, making an allowance for smaller ribs, a saving in weight over a wing of constant depth throughout its length of 3·5 lbs. per wing tip should easily be accomplished. The weight reduction for the whole aircraft in this case would be 14 lbs. Putting the argument in another way, the 2 ft. 6 in. length of tapered wing tip would be at least 40 per cent. lighter than a parallel wing of similar length. A saving of this amount surely justifies some small increase in cost. For tapers much shorter than the above an ordinary round tube secured to the webs is effective and saves considerable weight.



Interplane struts built from strip show great savings in weight over solid wooden struts and to a lesser extent over streamline tube. Such a strut is shown in Fig. 14. The strut consists of a steel leading edge, to the extremities of which plate end fittings are riveted. One such end fitting is shown. In general the leading edge is of curved channel shape and to the longitudinal edges is riveted a lightened web of channel form with the sides of the channel bent inwards. The edges of the fairing are grooved in the manner shown, and this portion of the complete strut is simply pulled on from one end and is held in place simply by the pressure of the grooves.

The fairing carries no end load and can be made either from a light alloy or very thin steel, consequently suitable stiffeners are required at intervals, these being simple pressed parts. A portion of one of the stiffeners is shown near the top of the fairing. The weight of such a strut 6 ft. long under a compressive load of 2,240 lbs. is 3·8 lbs.; the lightest timber

strut of this length and otherwise complying with the conditions would be 6·3 lbs., while the best solid-drawn streamline tube would weigh 4·5 lbs.

The above descriptions and illustrations by no means exhaust the possible methods of steel spar construction, but represent merely some of the designs of which the writer has had experience. Spars have been made with interlocking edges after the manner of Fig. 15, the basic idea presumably being the elimination of riveting or bolting processes. Others have been made with vertically corrugated webs; this latter feature, one imagines, effectively overcomes the trouble of the decreasing of spar depth under shear loads, but it is difficult to see how such a web could carry much end load.

It may be said, however, that methods now in use are likely to be replaced by technique of design and construction far superior to that at present existing, and that at no very distant date.

We may now turn our attention to questions of manufacture.

(To be continued.)

TECHNICAL LITERATURE.

SUMMARIES OF AERONAUTICAL RESEARCH COMMITTEE REPORTS.

ON THE FLOW OF AIR BEHIND AN INCLINED FLAT PLATE OF INFINITE SPAN.—By A. Fage, A.R.C.Sc., and F. C. Johansen, B.Sc. R. & M. No. 1104 (Ae. 281). (26 pages and 11 diagrams.) February, 1926. Price 1*s.* 3*d.* net.

Observations were taken of the pressure around the median section of a plate 6 in. wide mounted between the walls of a 7-ft. wind tunnel. It was found that the forces estimated by the Kirchhoff-Rayleigh theory are considerably below that obtained by experiment, but if the datum velocity taken is that which makes the theoretical velocity at the edge of the plate the same as that actually measured, good agreement between theory and experiment is reached at incidences greater than 30°.

Measurements of the frequency and spacing of the vortices behind the plate were made, and fairly good agreement reached with Karman's formula for the resistance of the plate in terms of the strength and spacing of the vortices. The longitudinal spacing of the vortices was found to be uniform for several plate widths measured down the tunnel.

THE AERODYNAMICS OF A SIMPLE SERVO-RUDDER SYSTEM. By H. M. Garner, M.A., and Flight-Lieut. C. E. W. Lockyer, R.A.F. Presented by the Director of Scientific Research, Air Ministry. R. & M. No. 1105 (Ae. 282). (8 pages and 2 diagrams.) May, 1927. Price 6*d.* net.

Servo-rudders provide a convenient means of reducing the force required to operate a large rudder, without danger of overbalance.

The system here considered is a rectangular rudder with a servo-rudder hinged to its trailing edge. The servo-rudder angle required to hold the main rudder over to a definite angle and the moment about the servo-rudder hinge have been calculated, for different combinations, from the results of aerofoil theory. The "efficiency" of the system has also been calculated.

The servo-rudder angle required to hold the main rudder over to a definite angle is found to vary comparatively little with the relative size of the servo-rudder, and since the "efficiency" increases as the relative size of the servo-rudder diminishes, it is always advantageous to keep the servo-rudder as small as possible.

The results given in this report require checking by systematic wind-tunnel tests on servo-rudders of this type over a large range of angles of incidence.

THE ROTATING WING IN AIRCRAFT. By H. E. Wimperis, M.A., F.R.Ae.S. R. & M. No. 1108. (6 pages and 3 diagrams.) August, 1926. Price 6*d.* net.

This paper, which has already been read before Section G of the British Association at Oxford on August 9, 1926, gives a general description of the working of an autogiro. The reasons for the success of the Cierva invention are carefully described, including the articulation of the wings at their root to allow for the varied conditions associated with the blades moving against, and with, the wind. Attention is also drawn to other forms of rotating winged aircraft such as the gyroplane, which is the freely rotating windmill of Cierva type adopted so as to be power-driven.

THE HIGH-DUTY COMPRESSION-IGNITION ENGINE. By D. R. Pye, M.A. R. & M. No. 1109. (15 pages.) August, 1926. Price 9*d.* net.

This paper was originally read before the British Association at the Oxford meeting in 1926, and thus brought to the attention of a wider circle the experiences already obtained, especially at the Royal Aircraft Establishment, on the light-weight compression ignition engine. The author draws attention to the advantages of this type of engine for a great variety of purposes, and to its possibilities in the direction of fuel economy and the saving of weight in material as compared with existing designs.

The figures obtained from the Royal Aircraft Establishment experiments show considerable promise, but up to date no engine has yet been designed with a weight as low as 4 lbs./h.p. It seems possible that further research will show how to design an engine which will work with the mean piston speed of 2,000 ft. per minute, while maintaining at the same time a mean effective pressure of at least 100 lbs. to the square inch. These possibilities are carefully discussed in relation to results here collected and obtained by Riehm, and Miller and Beardsley.

NOTE ON SOME FATIGUE DENSITY TESTS MADE ON ALUMINIUM AGGREGATE. By H. J. Gough, M.B.E., B.Sc. Work performed for the Engineering Research Board of the Department of Scientific and Industrial Research. R. & M. No. 1110 (M. 51). (8 pages.) June, 1927. Price 4*d.* net.

The tests described in this report were made for purposes of comparison with similar tests (previously reported)* on single crystals of aluminium.

The material used is that from which single crystals of aluminium were prepared and test results of which have been reported. In the present tests, this material in the poly-crystalline form has been used in the "as rolled," also in the "annealed" conditions. The endurance limit, under reversed direct stresses employing a Haigh machine, has been determined in each case. The density of each of the annealed specimens was determined before and after test.

The fatigue ranges for the hot-rolled, annealed, and monocrystalline form have the values of ± 3·3, ± 2·2, and ± 1·5 tons/inch² respectively. The strengthening effect of crystal boundaries and of a random crystal arrangement is clearly shown.

It is found that a definite decrease in density of the annealed specimens occurs as the result of the alternating stressing. This decrease varies from 0·037 to 0·100 per cent. of the value of the density in the unstressed state. A comparison of the results of the N.P.L. work on mono-crystalline and poly-crystalline specimens, also a consideration of the results obtained by other workers, suggests that a decrease in density of a metallic specimen due to cold work marks an effect which is confined to the neighbourhood of crystal boundaries. Where no such boundaries exist, as in the single crystal specimens, changes of density do not occur.

* R. & M. 1024. Some further tests on single crystals of aluminium employing reversed direct stresses. N.P.L. January, 1926.

A GENERAL THEORY OF THE AUTOGYRO. By H. Glauert, M.A. Presented by The Director of Scientific Research, Air Ministry. R. & M. No. 1111 (Ae. 285). (36 pages and 8 diagrams.) November, 1926. Price 1*s.* 6*d.* net.

An autogyro obtains remarkably high lift forces from a system of freely rotating blades, and it is important to develop a theory which will explain the behaviour of an autogyro and will provide a method of estimating the effect of changes in the fundamental parameters of the system.

A theory is developed depending on the assumptions that the angles of incidence of the blade elements are small, that the interference flow is similar to that caused by an ordinary aerofoil, and that only first order harmonics of periodic terms need be retained in the equations. An alternative method of analysis by considering the energy losses of an autogyro is developed in an appendix to the main report.

The maximum lift coefficient of an autogyro, using the disc area as fundamental area and the forward speed as fundamental speed, lies between 0·5 and 0·6 in general, and the best lift-drag ratio is of the order of 6 or 8 at most. Also, owing to the necessity of maintaining a sufficient ratio of tip speed to forward speed, the stalling speed of an autogyro must rise with the maximum speed of level flight, and so the principal merit of the autogyro system, the low landing speed, would disappear in the case of high-speed aircraft.

The analysis in this report is confined to the case of blades of constant chord and angle of pitch, but there would be no difficulty in extending the theory to tapered and twisted blades, provided these variations can be expressed in a simple mathematical form. It is not anticipated that an improvement of more than a few per cent. could be achieved by any such modifications.

ON THE INFLUENCE OF SUPERCHARGING ON THE PERFORMANCE OF AEROPLANES. By R. McKinnon Wood, M.B.E., B.A., A.M.Inst.C.E., F.R.Ae.S. Presented by the Director of Scientific Research, Air Ministry. R. & M. No. 1112. (Ae 286). (14 pages and 5 diagrams.) March, 1926. Price 9*d.* net.

This note discusses the improvement in the performance of an aeroplane, which may be expected from supercharging the engine (*a*) when a fixed airscrews (*b*) when a variable pitch airscrew, and (*c*) when a change speed gear is used. The question is discussed in a general theoretical way and diagrams are given to show the effects of supercharging on speed and climb at different heights, assuming typical data. The method of constructing these diagrams has been explained in some detail in order to assist the reader in drawing curves from different data.

To draw some brief conclusions from the calculations, it appears that supercharging involves some loss in performance at low heights unless "ground boosting" is used; but provides a great improvement at great heights. Much of the advantage of supercharging may be obtained without using a variable airscrew if the time to reach great heights is not important, or if it is only desired to improve performance at moderate heights. A change speed gear is a possible, but probably inferior, alternative to the variable airscrew. The reader may, however, best draw his conclusions from the diagrams.

CLOSED VESSEL EXPLOSIONS OF CARBON MONOXIDE, OXYGEN AND NITROGEN MIXTURES. By R. W. Fenning, M.B.E., B.Sc., D.I.C. Work performed for the Engineering Research Board of the Department of Scientific and Industrial Research. R. &. M. No. 1113 (E. 26). (12 pages and 2 diagrams.) January, 1927. Price 9*d.* net.

The programme of work in connection with the National Physical Laboratory closed vessel explosion apparatus includes the determination of the specific heat of gases at high temperatures. The present report details experiments from which the dissociation of carbon dioxide at high temperatures can be computed. The results given are consistent amongst themselves, but they should be compared with previous work from which they differ by about 2 per cent. (*see* R. & M. 998 "Gaseous combustion at medium pressures."—

R. W. Fenning, M.B.E., B.Sc., D.I.C.). This general question of dissociation has been dealt with in a paper communicated to the Royal Society by Mr. H. T. Tizard (Proc. Roy. Soc., A., Vol. 115, 1927, page 318), who used the collection of experimental data here given.

WIND TUNNEL AND DROPPING TESTS OF AUTOGYRO MODELS. By L. E. Caygill, B.Sc., A.M.I.M.E., and A. E. Woodward Nutt, B.A. Presented by the Director of Scientific Research, Air Ministry. R. & M. No. 1116 (Ae. 289). (5 pages and 4 diagrams.) November, 1926. Price 6*d*. net.

Wind tunnel and dropping tests under free flight conditions were carried out with models of autogyros to obtain further information, particularly as to their behaviour during vertical descent.

Two model autogyros, one of 2·2 ft. span of R.A.F. 30 section and the other of 10 ft. span of Göttingen 429 section, were constructed and dropped from a height of 90 ft., records of rate of descent and speed of rotation of the vanes being taken. The lift and drag of the 2·2 ft. model were also measured in the wind tunnels.

The values of normal force coefficient per unit disc area in vertical descent found in these tests for the two models were :—

2·2 ft. model in 7 ft. tunnel, 0·67 to 0·71.
2·2 ft. model in free descent, about 0·6.
10·0 ft. model in free descent, 0·58 to 0·71.

No evidence has been found of the very high value indicated by the full scale demonstration flights.

No further dropping tests are proposed. Wind tunnel tests are being made by the National Physical Laboratory and further full-scale tests will be made by the Royal Aircraft Establishment.

SCALE EFFECT ON THREE AEROFOILS AT LOW VALUES OF LV, R.A.F. 32, GÖTTINGEN 433, and GÖTTINGEN 410 WITH 2 PER CENT. CENTRE LINE CAMBER. By F. B. Bradfield, Math. and Nat. Sci. Triposes. Presented by the Director of Scientific Research, Air Ministry. R. &. M. No. 1117 (Ae. 290). (6 pages and 4 diagrams.) August, 1927. Price 6*d*. net.

Lift and drag have been measured at low values of LV on three aerofoil sections in connection with their use as pilot planes in model experiments.

Lift and drag were measured down to LV = $2\frac{1}{2}$.

Minimum drag at LV = $2\frac{1}{2}$ is about 0·025 for R.A.F. 32 section or for Göttingen 410 (cambered), and about 0·04 for Göttingen 433. As the scale decreases the no lift angle occurs at a more and more positive incidence, the slope of the lift curve remaining roughly constant. In the case of Göttingen 433 and Göttingen 410 (cambered), the ordinary stall has disappeared from the lift curves at the lowest LV's tested, the lift increasing gradually over a 40° incidence range.

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AMERICAN NATIONAL ADVISORY COMMITTEE REPORTS.

The National Advisory Committee for Aeronautics in the United States of America corresponds to our own Aeronautical Research Committee. Two distinct classes of reports are issued, the first being known as *Technical Reports*. These Technical Reports are printed, and are illustrated by photographs and/or drawings. The second class are known as *Technical Notes*, and are issued in mimeographed form so as to enable them to be rapidly distributed to a somewhat smaller, but directly interested, circle of readers. Copies of the Reports and Notes may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D.C., U.S.A.

T.R. No. 257. "PRESSURE DISTRIBUTION OVER A WING AND TAIL RIB OF A VE-7 AND OF A TS AIRPLANE IN FLIGHT." By J. W. Crowley, Jun., N.A.C.A.

This investigation was made at the Langley Memorial Aeronautical Laboratory, to determine the pressure distribution over a rib of the wing and over a rib of the horizontal tail surface of an aeroplane in flight, and to obtain information as to the time correlation of the loads occurring on these ribs. Two aeroplanes, VE-7 and TS, were selected in order to obtain the information for a thin and a thick wing section. In each case the pressure distribution was recorded for the full range of angle of attack in level flight and throughout violent manœuvres. Particular attention was given to the high and low angle of attack conditions. The results show ; (*a*) That the present rib load specifications in use by the Army Air Corps and the Bureau of Aeronautics, Navy Department, are in fair agreement with the loads actually occurring in flight, but could be slightly improved ; (*b*) that there appears to be no definite sequence in which wing and tail surface ribs reach their respective maximum loads in different manœuvres ; (*c*) that in accelerated flight, at air speeds less than or equal to 60 per cent. of the maximum speed, the accelerations measured agree very closely with the theoretically possible maximum accelerations. In manœuvres at higher air speeds, the observed accelerations were smaller than those theoretically possible.

T.R. No. 258. "SOME FACTORS AFFECTING THE REPRODUCIBILITY OF PENETRATION AND THE CUT-OFF OF OIL SPRAYS FOR FUEL-INJECTION ENGINES." By E. G. Beardsley, N.A.C.A.

This investigation was undertaken at the Langley Memorial Aeronautical Laboratory, in connection with a general research on fuel-injection engines for aircraft. The purpose of the investigation was to determine the factors controlling the reproducibility of spray penetration and secondary discharges after cut-off.

The development of single sprays from automatic injection valves was recorded by means of special high-speed photographic apparatus capable of taking 25 consecutive pictures of the moving spray at a rate of 4,000 per second. The effects of two types of injection valves, injection-valve tube length, initial pressure in the injection-valve tube, speed of the injection control mechanism, and time of spray cut-off, on the reproducibility of spray penetration, and on secondary discharges were investigated.

It was found that neither type of injection valve materially affected spray reproducibility. The initial pressure in the injection-valve tube controlled the reproducibility of spray penetrations. An increase in the initial pressure or in the length of the injection-valve tube slightly increased the spray penetration within the limits of this investigation. The speed of the injection-control mechanism did not affect the penetration.

Analysis of the results indicates that secondary discharges were caused in this apparatus by pressure waves initiated by the rapid opening of the cut-off valve. The secondary discharges were eliminated in this investigation by increasing the length of the injection-valve tube.

T.R. No. 259. "CHARACTERISTICS OF PROPELLER SECTIONS TESTED IN THE VARIABLE DENSITY WIND TUNNEL." By Eastman N. Jacobs, N.A.C.A.

Tests were carried out in the variable density wind tunnel at the Langley Memorial Aeronautical Laboratory on six aerofoil sections used by the Bureau of Aeronautics as propeller sections. The sections were tested at pressures of 1 and 20 atmospheres corresponding to Reynolds Numbers of about 170,000 and 3,500,000. The results obtained, besides providing data for the design of propellers, should be of special interest because of the opportunity afforded for the study of scale effect on a family of aerofoil sections having different thickness ratios.

T.R. No. 260. "THE EFFECT OF A FLAP AND AILERONS ON THE N.A.C.A. M6 AIRFOIL SECTION." By George J. Higgins and Eastman N. Jacobs, N.A.C.A.

This report contains the results obtained at the Langley Memorial Aeronautical Laboratory on an N.A.C.A. M 6 aerofoil, fitted with a flap and ailerons and tested in the variable-density wind tunnel at a density of 20 atmospheres. Aerofoil characteristics are given for the model up to 48 degs. angle of attack with the flap set at various angles, and also with the ailerons set at similar angles. The approximate lift distribution and the centre of pressure variation along the span are determined with the model at 18 degs. angle of attack and with the ailerons displaced 20 degs. Approximate rolling moment and yawing moment coefficients are determined for the various aileron settings.

A comparison of the calculated angles of zero lift and the calculated lift and moment coefficients with those observed is given in the appendix.

T.R. No. 261. "RESISTANCE AND COOLING POWER OF VARIOUS RADIATORS." By R. H. Smith, Construction Department, Washington Navy Yard.

This report combines the wind-tunnel results of radiator tests made at the Navy aerodynamical laboratory in Washington during the summers of 1921, 1925 and 1926. In all, 13 radiators of various types and capacities were given complete tests for figure of merit. Twelve of these were tested for resistance to water flow and a fourteenth radiator was tested for air resistance alone, its heat-dissipating capacity being known. All the tests were conducted in the 8 by 8 ft. tunnel, or in its 4 by 8 ft. restriction, under conditions as nearly the same as possible. That is to say, as far as possible, the general arrangement and condition of the apparatus, the observation intervals, the ratio of water flow per unit of cooling surface, the differential temperatures, and the air speeds were the same for all. Also, for reasons of comparison, the L/D value of 6, which was assumed in the 1921 tests as the L/D of the aeroplane using the radiator, was also used in the more recent tests.

No attempt is made to enter upon the theory of heat dissipation. Only the actual test results are given and reduced to coefficient form. The precision of the tests as representative of full-flight performance is definitely known only in the case of the HN.2. The McCook Field full-flight performance and the Navy tunnel performance of this radiator agree within about 3 per cent.

Since this full-flight test was made with unusual care, and since the wind-tunnel tests on all the radiators were made not only accurately but also at almost full scale, it would seem probable that these tests represent quite accurately the full-flight performances in actual service.

T.R. No. 262. "FRICTION OF AVIATION ENGINES." By S. W. Sparrow and M. A. Thorne, Bureau of Standards.

The first portion of this report discusses measurements of friction made in the altitude laboratory of the Bureau of Standards between 1920 and 1926 under research authorisation of the National Advisory Committee for Aeronautics. These are discussed with reference to the influence of speed, barometric pressure, jacket-water temperature, and throttle opening upon the friction of aviation engines. It is concluded that (1) Changes in friction due to changes in the temperature of the air entering the engine are negligible. (2) Changes in friction which result from changes in atmospheric pressure are due primarily to changes in pumping loss. An approximate figure for the engines mentioned in this report is that the friction mean effective pressure decreases about one-tenth of a pound per square inch for each decrease of 1 cm. of mercury in the barometric pressure. (3) The increase in friction resulting from a decrease in throttle opening is due to the change in pumping loss. For the engines mentioned in this report the change in friction mean effective pressure which accompanies a change in manifold suction of 1 in. (2·54 cms.) of mercury ranges from 0·20 lb. per sq. in. obtained at an engine speed of 1,200 r.p.m. to 0·39 at 1,800 r.p.m. (4) For the range of speeds covered in this report, namely, from 1,000 to 2,200 r.p.m., the friction mean effective pressure increases with speed, but ordinarily the percentage increase is less than the corresponding percentage increase in speed. At low engine speeds the friction mean effective pressure changes much less with change in speed and in some instances remains practically constant. (5) Friction

depends upon the viscosity of the oil upon the cylinder walls, which in turn depends upon the temperature of the jacket water. (6) While theoretical considerations would lead one to expect an increase in friction with increase in compression ratio the evidence at hand incicates that this effect is slight.

The second section of the report deals with measurements of the friction of a group of pistons differing from each other in a single respect, such as length, clearness, area of thrust face, location of thrust face, etc. Results obtained with each type of piston are discussed and attention is directed particularly to the fact that the friction chargeable to piston rings depends upon piston design as well as upon ring design. This is attributed to the effect of the rings upon the thickness and distribution of the oil film which, in turn, affects the friction of the piston to an extent which depends upon its design.

T.R. No. 263. "PRELIMINARY FLIGHT TESTS OF THE N.A.C.A. ROOTS TYPE AIRCRAFT ENGINE SUPERCHARGER." By Arthur W. Gardiner and Elliott G. Reid, N.A.C.A.

An investigation of the suitability of the N.A.C.A. Roots type aircraft engine supercharger to flight-operating conditions, as determined by the effects of the use of the supercharger upon engine operation and aeroplane performance, is described in this report.

The supercharger has been previously described in N.A.C.A. Technical Report No. 230; the results of laboratory tests are also given there. The compressor has a displacement of 0·51 cub. ft. per revolution, and weighs 88 lbs.

The selection of a suitable propeller and the provision of satisfactory intake ducts and adequate engine cooling were preliminary problems. The supercharger was first tested in a modified DH 4 aeroplane with a 5·4 compression-ratio "Liberty-12" engine. Two sets of drive gears, which enabled the maintenance of sea-level pressure at the carburettor intake up to 12,000 and 20,000 ft., were provided. The higher gear ratio supercharger was next tested in a DT.2 aeroplane, which was later converted into a twin-float seaplane; the DT.2 also had a "Liberty" engine. Loads up to 2,000 lbs. were carried in the seaplane with normal and supercharged engines.

Attention was concentrated on the operation of the engine-supercharger unit, and on the improvement of climbing ability; some information concerning high speeds at altitude was obtained.

The supercharger was found to be satisfactory under flight-operating conditions. Although two failures occurred during the tests, the causes of both were minor and have been eliminated. Careful examination of the engines revealed no detrimental effects which could be attributed to supercharging.

Marked improvements in climbing ability and high speeds at altitude were effected. It was also found that the load which could be carried to a given moderate or high altitude in a fixed time was considerably augmented. A slight sacrifice of low-altitude performance was necessitated, however, by the use of a fixed pitch propeller.

From a consideration of the very satisfactory flight performance of the Roots supercharger and of its inherent advantages, it is concluded that this type is particularly attractive for use in certain classes of commercial aeroplanes and in a number of military types.

T.R. No. 264. "DIFFERENTIAL PRESSURES ON A PITOT-VENTURI AND A PITOT-STATIC NOZZLE OVER 360° PITCH AND YAW." By R. M. Bear, Construction Department, Washington Navy Yard.

Measurements of the differential pressures on two Navy air-speed nozzles, consisting of a Zahm-type Pitot-Venturi tube and a SQ.16 two-pronged Pitot-static tube, in a tunnel air stream of fixed speed at various angles of pitch and yaw between 0° and ± 180°, show for a range over − 20° to + 20° pitch and yaw, indicated air speeds varying very slightly over 2 per cent. for the Zahm type and a maximum of about 5 per cent. for the SQ.16 type from the calibrated speed at 0°.

For both types of air-speed nozzle the indicated air speed increases slightly as the tubes are pitched or yawed several degrees from their normal 0° attitude, attains a maximum around ± 15° to 25°, declines rapidly therefrom as ± 40° is passed, to zero in the vicinity of ± 70° to 100°, and thence fluctuates irregularly from thereabouts to ± 180°. The complete variation in indicated air speed for the two tubes over 360° pitch and yaw is graphically portrayed in Figs. 9 and 10.

For the same air speed and 0° pitch and yaw the differential pressure of the Zahm type Pitot-Venturi nozzle is about seven times that of the SQ.16 type two-pronged Pitot-static nozzle.

T.R. No. 265. "A FULL-SCALE INVESTIGATION OF GROUND EFFECT." By Elliott G. Reid, N.A.C.A.

This report describes flight tests which were made with a Vought VE.7 aeroplane to determine the effects of flying close to the ground.

It is found that the drag of an aeroplane is materially reduced upon approaching the ground, and that the reduction may be satisfactorily calculated according to theoretical formulas.

Several aspects of ground effect which have had much discussion are explained.

T.R. No. 266. "AIR FORCE AND MOMENT FOR N-20 WING WITH CERTAIN CUT-OUTS." By R. H. Smith, Construction Department, Washington Navy Yard.

The aeroplane designer often finds it necessary, in meeting the requirements of visibility, to remove area or otherwise locally to distort the plan or section of an aeroplane wing. This report, prepared for the Bureau of Aeronautics, January 15, 1925, contains the experimental results of tests on six 5 by 30 in. N.20 wing models, cut out or distorted in different ways, which were conducted in the 8 ft. by 8 ft. wind tunnel of the Navy Aerodynamical Laboratory in Washington in 1924.

The measured and derived results are given without correction for V/v or for wall effect and for standard air density $\rho = 0{\cdot}00237$ slug per cub. ft.

T.R. No. 267. "DRAG OF WINGS WITH END PLATES." By Paul E. Hemke, N.A.C.A.

In this report a formula for calculating the induced drag of multiplanes with end plates is derived. The frictional drag of the end plates is also calculated approximately. It is shown that the reduction of the induced drag, when end plates are used, is sufficiently large to increase the efficiency of the wing.

Curves showing the reduction of drag for monoplanes and biplanes are constructed; the influence of gap-chord ratio, aspect ratio, and height of end plate are determined for typical cases. The method of obtaining the reduction of drag for a multiplane is described.

Comparisons are made of calculated and experimental results obtained in wind-tunnel tests with airfoils of various aspect ratios and end plates of various sizes. The agreement between calculated and experimental results is good.

Analysis of the experimental results shows that the shape and section of the end plates are important.

T.R. No. 268. "FACTORS IN THE DESIGN OF CENTRIFUGAL-TYPE INJECTION VALVES FOR OIL ENGINES." By W. F. Joachim and E. G. Beardsley, N.A.C.A.

This research was undertaken at the Langley Memorial Aeronautical Laboratory, in connection with a general study of the application of the fuel injection engine to aircraft. The purpose of the investigation was to determine the effect of four important factors in the design of a centrifugal type automatic injection valve on the penetration, general shape, and distribution of oil sprays.

The general method employed was to record the development of single sprays by means of special high-speed photographic apparatus capable of taking 25 consecutive pictures of the moving spray at a rate of 4,000 per second. Investigations were made concerning the effects on spray characteristics of the helix angle of helical grooves, the ratio of the cross-sectional area of the orifice to that of the grooves, the ratio of orifice length to diameter, and the position of the seat. The sprays were injected at 6,000, 8,000, and 10,000 lbs. per square inch pressure into air at atmospheric pressure and into nitrogen at 200, 400, and 600 lbs. per square inch pressure. Orifice diameters from 0·012 to 0·040 inch were investigated.

It was found that decreasing the pitch of the helical grooves and thus increasing the centrifugal force applied to the spray increased the spray cone angle considerably, although the percentage increase was much less in dense air than in the atmosphere. On the other hand, the spray penetration decreased with increase in the amount of centrifugal force applied. About twice as much spray volume per unit oil volume was obtained with a high centrifugal spray as with a noncentrifugal spray. The spray cone angle increased, and the spray volume to oil volume ratio and spray penetration decreased with increase in the ratio of orifice area to groove area. Maximum spray penetration was obtained with a ratio of orifice length to diameter of about 1·5. Slightly greater penetration was obtained with the seat directly before the orifice.

T.R. No. 269. "AIR FORCE TESTS OF SPERRY MESSENGER MODEL WITH SIX SETS OF WINGS." By James M. Shoemaker, N.A.C.A.

The purpose of this test was to compare six well-known aerofoils, the R.A.F. 15, U.S.A. 5, U.S.A. 27, U.S.A. 35-B, Clark Y, and Göttingen 387, fitted to the Sperry Messenger model at full-scale Reynolds Number as obtained in the variable-density wind tunnel of the National Advisory Committee for Aeronautics; and to determine the scale effect on the model equipped with all the details of the actual aeroplane. The results show a large decrease in minimum drag coefficient upon increasing the Reynolds Number from about one-twentieth scale to full scale. Maximum lift coefficient was increased with increasing scale for all the aerofoils except the Göttingen 387, for which it was slightly decreased. A comparison is made between the results of these tests and those obtained from tests made in this tunnel on aerofoils alone.

T.R. No. 270. "THE MEASUREMENT OF PRESSURE THROUGH TUBES IN PRESSURE DISTRIBUTION TESTS." By Paul E. Hemke, N.A.C.A.

The tests described in this report were made to determine the error caused by using small tubes to connect orifices on the surface of aircraft to central pressure capsules in making pressure-distribution tests.

Aluminium tubes of three-sixteenths inch inside diameter were used to determine this error. Lengths from 20 ft. to 226 ft. and pressures whose maxima varied from 2 ins. to 140 ins. of water were used. Single-pressure impulses for which the time of rise of pressure from zero to a maximum varied from 0·25 sec. to 3 secs. were investigated.

The results show that the pressure recorded at the capsule on the far end of the tube lags behind the pressure at the orifice end and experiences also a change in magnitude. For the values used in these tests the time lag and pressure change vary principally with the time of rise of pressure from zero to a maximum and the tube length. Curves are constructed showing the time lag and pressure change. Empirical formulas are also given for computing the time lag.

Analysis of pressure-distribution tests made on aeroplanes in flight shows that the recorded pressures are slightly higher than the pressures at the orifice and that the time lag is negligible. The apparent increase in pressure is usually within the experimental error, but in the case of the modern pursuit type of aeroplane the pressure increase may be 5 per cent. For pressure-distribution tests on airships the analysis shows that the time lag and pressure change may be neglected.

T.R. No. 271. "PRESSURE DISTRIBUTION TESTS ON PW-9 WING MODELS SHOWING EFFECTS OF BIPLANE INTERFERENCE." By A. J. Fairbanks, N.A.C.A.

In this report tests are described in which the distribution of pressures over models of the wings of the PW-9 aeroplane was investigated. The wing models were tested individually and in the biplane combination. The investigation was conducted in the amtospheric wind tunnel of the National Advisory Committee for Aeronautics. It is concluded in this paper that the effect of biplane interference on the pressures on the wings is practically confined to the lower surface of the upper wing and the upper surface of the lower wing; that the overhanging portion of the upper wing is not greatly affected by the presence of the lower wing; and that a slight washing at the centre section of the upper wing satisfactorily compensates for a reduced chord at this section (providing the aerofoil section is not mutilated) and prevents a large reduction in the normal force over this portion of the wing.

T.R. No. 272. "THE RELATIVE PERFORMANCE OBTAINED WITH SEVERAL METHODS OF CONTROL OF AN OVER-COMPRESSED ENGINE USING GASOLINE." By Arthur W. Gardiner and William E. Whedon, N.A.C.A.

This report presents some results obtained at the Langley Memorial Aeronautical Laboratory during an investigation to determine the relative

performance characteristics for several methods of control of an over-compressed engine using gasoline and operating under sea-level conditions. For this work, a special single-cylinder test engine, 5-in. bore by 7-in. stroke, and designed for ready adjustment of compression ratio, valve timing and valve lift while running, was used. This engine has been fully described in N.A.C.A. Technical Report No. 250.

Tests were made at an engine speed of 1,400 r.p.m. for compression ratios ranging from 4 to 7·6. The air-fuel ratios were on the rich side of the chemically correct mixture and were approximately those giving maximum power. When using plain domestic aviation gasoline, detonation was controlled to a constant, predetermined amount (audible), such as would be permissible for continuous operation, by (*a*) throttling the carburettor, (*b*) maintaining full throttle but greatly retarding the ignition, and (*c*) varying the timing of the inlet valve to reduce the effective compression ratio. For the first and third methods, the throttle opening and the valve timing, respectively, were adjusted so that the ignition timing could be advanced slightly beyond the advance, giving maximum power without exceeding the standard of permissible detonation. The optimum performance for the engine when using a non-detonating fuel, consisting of 80 per cent. of commercial benzol and 20 per cent. of aviation gasoline, was obtained as a basis for comparison.

The following comparative results are based on the optimum performance for the engine obtained with the non-detonating fuel at a compression ratio of 4·7. The power and fuel consumption with method (*b*) remained substantially constant at the higher compression ratios, the order of the ignition timing permitting full throttle operation ranging from 30° at 4·7 to 3° at 7·3; exhaust temperatures, heat loss to the cooling water, and explosion pressures at the higher ratios were normal. At a compression ratio of 7·5, the power obtained with method (*a*) was about 39 per cent. less and the fuel consumption was considerably lower; with method (*b*), time of inlet-valve opening constant and time of inlet-valve closing varied, the power was about 23 per cent. less and the fuel consumption was greatly increased; with method (*c*), time of inlet opening and closing varied simultaneously, the power was about 29 per cent. less and the fuel consumption was greatly increased.

From these results, it may be concluded that method (*c*) gives the best all-round performance and, being easily employed in service, appears to be the most practicable method for controlling an overcompressed engine using gasoline at low altitudes.

T.R. No. 273. "Wind Tunnel Tests on Autorotation and the 'Flat Spin.'" By Montgomery Knight, N.A.C.A.

This report deals with the autorotational characteristics of certain differing wing systems as determined from wind-tunnel tests made at the Langley Memorial Aeronautical Laboratory. The investigation was confined to autorotation about a fixed axis in the plane of symmetry and parallel to the wind direction. Analysis of the tests leads to the following conclusions:

Autorotation below 30° angle of attack is governed chiefly by wing profile and above that angle by wing arrangement.

The strip method of autorotation analysis gives uncertain results between maximum C_L and 35°.

The polar curve of a wing system, and to a lower degree of accuracy the polar of a complete airplane model are sufficient for direct determination of the limits of rotary instability, subject to strip-method limitations.

The results of the investigation indicate that in free flight a monoplane is incapable of flat spinning, whereas an unstaggered biplane has inherent flat-spinning tendencies.

The difficulty of maintaining equilibrium in stalled flight is due primarily to rotary instability, a rapid change from stability to instability occurring as the angle of maximum lift is exceeded.

T.R. No. 274. "The N.A.C.A. Photographic Apparatus for Studying Fuel Sprays from Oil Engine Injection Valves and Test Results from Several Researches." By Edward G. Beardsley, N.A.C.A.

Apparatus for recording photographically the start, growth, and cut-off of oil sprays from injection valves has been developed at the Langley Memorial Aeronautical Laboratory. The apparatus consists of a high-tension transformer by means of which a bank of condensers is charged to a high voltage. The controlled discharge of these condensers in sequence, at a rate of several thousand per second, produces electric sparks of sufficient intensity to illuminate the moving spray for photographing. The sprays are injected from various types of valves into a chamber containing gases at pressures up to 600 lbs. per square inch.

Several series of pictures are shown. The results give the effects of injection pressure, chamber pressure, specific gravity of the fuel oil used, and injection-valve design upon spray characteristics.

T.R. No. 275. "The Effect of the Walls in Closed-Type Wind Tunnels." By George J. Higgins, N.A.C.A.

A series of tests has been conducted during the period 1925–27 by the National Advisory Committee for Aeronautics in the variable density wind tunnel on several airfoil models of different sizes and sections to determine the effect of tunnel-wall interference and to determine a correction which can be applied to reduce the error caused thereby. The use of several empirical corrections was attempted with little success. The Prandtl theoretical corrections give the best results, and their use is recommended for correcting closed wind-tunnel results to the conditions of free air.

An appendix is attached wherein the experimentally determined effect of the walls on the tunnel velocity very close to their surface is given. This is of special interest because a "scale effect" was found in the boundary layer with a change in the density of the tunnel air.

T.R. No. 276. "Combustion Time in the Engine Cylinder and its Effect on Engine Performance." By Charles F. Marvin, Jun., Bureau of Standards.

As part of a general program to study combustion in the engine cylinder and to correlate the phenomena of combustion with the observed performance of actual engines, this paper, which was outlined by S. W. Sparrow, and the work undertaken at the request of the National Advisory Committee for Aeronautics, presents a sketchy outline of what may happen in the engine cylinder during the burning of a charge. It also suggests the type of information needed to supply the details of the picture and points out how combustion, time and rate affect the performance of the engine.

A theoretical concept of a flame front which is assumed to advance radially from the point of ignition is presented, and calculations based on the area and velocity of this flame and the density of the unburned gases are made to determine the mass rate of combustion. From this rate the mass which has been burned and the pressure at any instant during combustion are computed.

This process is then reversed in an effort to determine actual rates of combustion and flame velocities from the pressures as recorded on indicator diagrams.

The effects of different rates of combustion on engine performance are then discussed and the importance of proper spark advance is emphasised.

T.R. No. 277. "The Comparative Performance of an Aviation Engine at Normal and High Inlet Air Temperatures." By Arthur W. Gardiner and Oscar W. Schey, N.A.C.A.

This report presents some results obtained at the Langley Memorial Aeronautical Laboratory during an investigation to determine the effect of high inlet air temperature on the performance of a Liberty-12 aviation engine. The purpose of this investigation was to ascertain, for normal service carburettor adjustments and a fixed ignition advance, the relation between power and temperature for the range of carburettor air temperatures that may be encountered when supercharging to sea-level pressure at altitudes of over 20,000 ft. and without intercooling when using plain aviation gasoline and mixtures of benzol and gasoline.

Laboratory tests were made at full throttle over the speed range from 1,400 to 1,800 r.p.m., in which the pressure at the carburettor and exhaust was maintained sensibly constant and the inlet air temperature varied from 45° to 180° F. The range of mixtures was that normally used in flight. Plain aviation gasoline, a mixture consisting of 30 per cent. (by volume) of commercial benzol and 70 per cent. gasoline, and a mixture of 65 per cent. benzol and 35 per cent. gasoline were used. Additional tests were made with a Wright E–4 aviation engine.

The results show that for the conditions of test, both the brake and indicated power decrease with increase in air temperature at a faster rate than given by the theoretical assumption that power varies inversely as the square root of the absolute temperature. On a brake basis, the order of the difference in power for a temperature difference of 120° F. is 3 to 5 per cent. The observed relation between power and temperature when using the 30 to 70 blend was found to be linear. But, although these differences are noted, the above theoretical assumption may be considered as generally applicable except where greater precision over a wide range of temperatures is desired, in which case it appears necessary to test the particular engine under the given conditions.

T.R. No. 278. "Lift, Drag, and Elevator Hinge Moments of Handley-Page Control Surfaces." By R. H. Smith, Construction Department, Washington Navy Yard.

This report combines the wind-tunnel results of tests on four control surface models made in the two wind tunnels of the Navy aerodynamical laboratory, Washington Navy Yard, during the years 1922 and 1924. The purpose of the tests was to compare, first, the lifts and the aerodynamic efficiencies of the control surfaces from which their relative effectiveness as tail planes could be determined; then the elevator hinge moments upon which their relative ease of operation depended. The lift and drag forces on the control surface models were obtained for various stabilizer angles and elevator settings in the 8 by 8-ft. tunnel by the writer in 1922: the corresponding hinge moments were found in the 4 by 4-ft. tunnel by Mr. R. M. Bear in 1924.

T.R. No. 279. "Tests on Models of Three British Airplanes in the Variable Density Wind Tunnel." By George J. Higgins and George L. DeFoe, N.A.C.A., and W. S. Diehl, Bureau of Aeronautics, Navy Department.

This report contains the results of tests made in the National Advisory Committee for Aeronautics variable density wind tunnel on three aeroplane models supplied by the British Aeronautical Research Committee. These models, the BE–2E with R.A.F. 19 wings, the Bristol Fighter with R.A.F. 15 wings, and the Bristol Fighter with R.A.F. 30 wings, were tested over a wide range in Reynolds Numbers in order to supply data desired by the Aeronautical Research Committee for scale-effect studies.

The maximum lifts obtained in these tests are in excellent agreement with the published results of British tests, both model and full scale. No attempt is made to compare drag data, owing to the omission of tail surfaces, radiator, etc., from the model, but it is shown that the scale effect observed on the drag coefficients in these tests is due to a large extent to the parts of the models other than the wings.

T.R. No. 280. "The Gaseous Explosive Reaction: the Effect of Inert Gases." By F. W. Stevens, Bureau of Standards.

(1) Attention is called in this report to previous investigations of gaseous explosive reactions carried out under constant volume conditions, where the effect of inert gases on the thermodynamic equilibrium was determined. The advantage of constant pressure methods over those of constant volume, as applied to studies of the gaseous explosive reaction, is pointed out, and the possibility of realising for this purpose a constant pressure bomb mentioned.

(2) The application of constant-pressure methods to the study of gaseous explosive reactions, made possible by the use of a constant-pressure bomb, led to the discovery of an important kinetic relation connecting the rate of propagation of the zone of explosive reaction within the active gases, with the initial concentrations of those gases: $s = k_1 [A]^{n1} [B]^{n2} [C]^{n3}$.

(3) By a method analogous to that followed in determining the effect of inert gases on the equilibrium constant K, the present paper records an attempt to determine their kinetic effect upon the expression given above. It is found that this effect for the inert gases investigated—N_2, He, and CO_2—may be expressed as

$$s = k_1 [A]^{n1} [B]^{n2} [C]^{n3} \text{ ——— } + \beta G_1$$

where G_1 represents the initial concentration of the inert gas. From results obtained, it seems probable that the value of β depends upon the combined effect of the thermal properties of the inert gas on the heat distribution of the reaction, the property of heat conductivity being predominant.

(4) An example of the utility of the constant-pressure bomb for the study of the kinetics of the gaseous explosive reaction is offered in the results of the present paper.

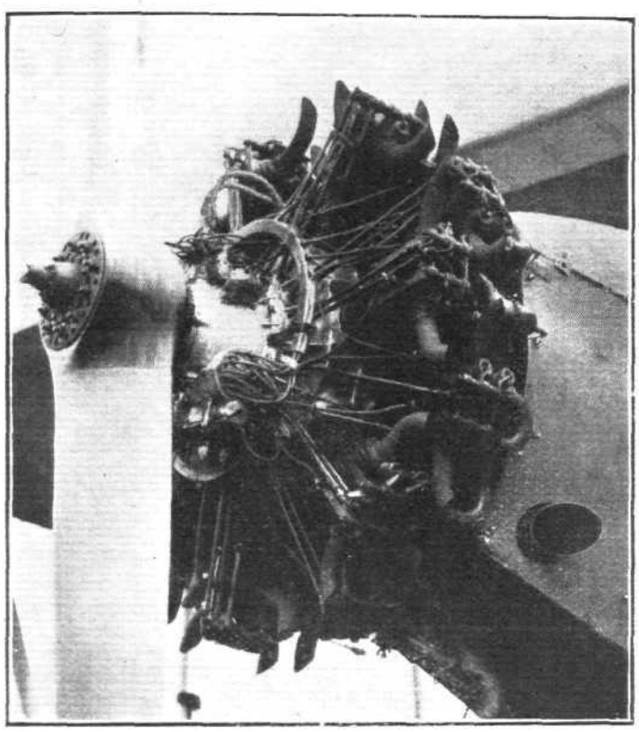
FLIGHT
AIRCRAFT ENGINEER & AIRSHIPS

THE ARMSTRONG-SIDDELEY "LEOPARD" AERO ENGINE

700 B.H.P. at 1,500 R.P.M.

THE 700-750 h.p. Leopard engine has been designed and developed by Armstrong-Siddeley Motors, Ltd., of Coventry, for use in torpedo, heavy bombing and load-carrying aircraft, and is believed to be the most powerful air-cooled radial engine in production in the world.

The general lay-out and design follows very closely that of the same company's well-known "Jaguar" engine, and consists of two "banks" or rows, each comprising seven cylinders mounted radially on the crankcase.



["FLIGHT" *Photograph*

The Armstrong-Siddeley "Leopard" Aero Engine as fitted in a Hawker "Horsley" bomber.

The principal departure from the "Jaguar" design is that the induction fan is geared to run at a higher speed than the crankshaft in order to obtain a better volumetric efficiency, and that four valves are fitted to each cylinder instead of two, this being rendered necessary by the increased cylinder capacity. Brief descriptions of the various units follow.

The crankcase is a one-piece aluminium casting, the front portion carrying the tappet guides, a spigot which supports the front cover, and the front crankshaft bearing. The central portion, or barrel, which carries the cylinders, is very heavily webbed both inside and outside. The rear portion has a spigot which supports the induction fan and casing, the petrol pump, carburettor, and the rear crankshaft bearing.

The steel cylinder barrels are secured to the crankcase by clamping rings which are of a wedge-shaped section, these details following standard Armstrong-Siddeley practice. The cylinder head, an aluminium casting heavily finned to secure a maximum cooling effect, is screwed and shrunk on to the cylinder barrel, where it is secured permanently by a screwed locking ring, the joint being steel-to-aluminium without joint washer. Here again one notices that well-tried Armstrong-Siddeley practice is retained.

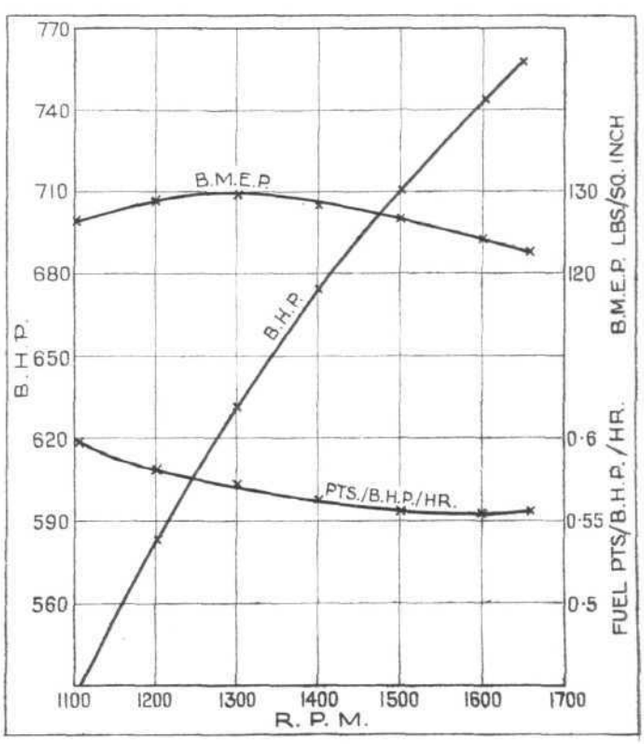
There are two inlet and two exhaust valves per cylinder, operated by rockers which pivot on two spindles mounted on the cylinder head. The spindles at their rear ends are anchored to the top of the head; their front ends are supported by a compensating bracket which is anchored to a point near the bottom of the cylinder-head. This bracket is made of special steel which has a very low coefficient of expansion, with the result that the longitudinal expansion of the cylinder has practically no effect on the tappet clearances. This means that adjustment to the tappets is very seldom called for and that starting up is made much easier.

The valve rockers are operated by push rods and tappets from the cam drum, which is situated inside the front portion of the crankcase, the tappet clearance adjustment being provided in the push rods. The valve seats and valve guides are renewable, the former being screwed and shrunk into the heads, while the latter are a press fit. The sparking plugs are accommodated in adaptors which are screwed and pegged into the heads.

The cam drum has three inlet cams and three exhaust cams, and rotates at one-sixth crankshaft speed. Rollers and tappets transmit the cam motion to the push rods.

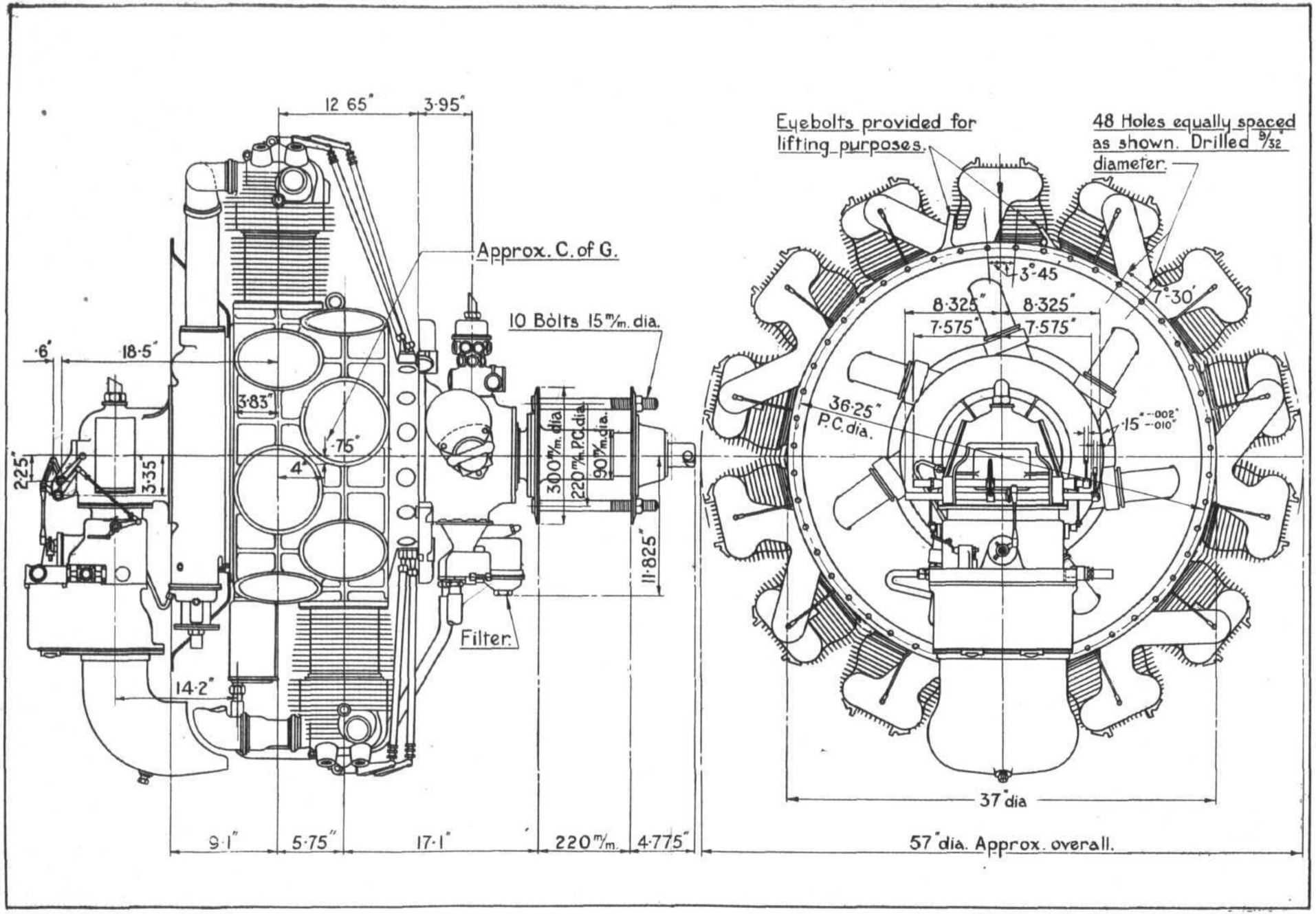
The pistons are machined all over from "Y" alloy forgings. Each carries two compression and one scraper ring, all three rings being situated above the gudgeon-pin. The air-hardening steel gudgeon-pin floats in the piston and connecting-rod bush and is located endways in order to prevent scoring the cylinder walls.

Each "bank" of seven cylinders and pistons drives the crankshaft by means of one master and six auxiliary connecting rods. The large end of each master connecting rod carries six anchor pins, to which the inner ends of the auxiliary connecting rods are anchored. The master connecting rods are bushed to take the anchor pins which float in the bushes, and are spaced so as to give an equal compression ratio in every cylinder. The master connecting rods bear on the crank-pins by means of white-metalled bushes, which are made in two halves and prevented from turning in the master rods by dowels.



The Armstrong-Siddeley "Leopard": Power, B.M.E.P. and Consumption Curves. Torque, in inch-lbs., at any point equals 236 × B.M.E.P. Maximum torque (at 1,300 r.p.m.) 30,584 inch-lbs.

The crankshaft is made in one piece and has two throws set 180 degrees apart, each crank pin carrying one master rod and six auxiliary connecting rods. It is bored out to save weight and the holes serve the purpose of distributing the lubricating oil. It is carried by two large roller bearings, one being located just behind the rear crank throw and the other just in front of the front crank throw. The crankshaft extends beyond its front roller bearing and this portion carries the timing gear and cam drum, a bevel gear (which



THE ARMSTRONG-SIDDELEY "LEOPARD" AERO-ENGINE : These Installation Drawings, with the main dimensions given, should enable aircraft designers to "fit" the engine into their designs.

drives the oil pumps, magnetos, gas distributor and C.C. gun gear), and the air screw thrust bearing. The rear end of the crankshaft carries the spur gear which drives the induction fan. The front and rear webs of the crankshaft carry the necessary balance weights.

Mixture is supplied to the engine by a Claudel-Hobson A.V.T. 100 carburettor through the medium of an induction fan which delivers the mixture into an annular induction casing. Thence the mixture passes to the cylinders by means of induction pipes. Experiments have proved that the use of an induction fan of this kind very considerably increases the volumetric efficiency of the engine and also gives a perfectly even distribution to all cylinders.

The carburettor is supported on an induction elbow attached to the rear end of the engine, the controls and air intake pipes being integral with the carburettor and engine.

Ignition is controlled by two magnetos of the latest approved type, each having fourteen terminals. The magnetos are accessibly mounted on the front of the engine and are bevel driven from the crankshaft. There are two sparking plugs per cylinder, the braided H.T. cables being supported in a wire carrier mounted on the crankcase. Fine adjustment of the magneto timing is provided by serrated couplings incorporated in the magneto drive.

The gas distributor which is mounted on the front of the engine is driven from the crankshaft, the cams for the C.C. gun gear being incorporated in its casing.

The oil pumps are mounted on the front of the engine and are bevel driven from the crankshaft. The pressure pump, which has a relief valve to govern the oil pressure, delivers oil under pressure through a filter to the centre of the crankshaft and thence to the connecting rods and bearings. At the bottom of the crankcase are an oil sump and filter, into which the oil drains from the engine. When the engine is stationary, the surplus oil passes from the crankcase and collects in this sump, flooding of the crankcase and lower cylinders being thus prevented.

Oil is drawn from this sump by a scavenge oil pump situated underneath the pressure pump, the scavenge oil pump then delivering the oil to the oil tank on the aircraft. On its way to the oil tank, the oil passes through the jacketing of the carburettor and induction elbow, thereby imparting a positive degree of heating to the induction system.

A gear type petrol pump and relief valve of approved design are carried at the rear end of the engine, prolonged tests having proved this pump to be very successful.

A tachometer drive which is fitted to the engine is situated just above the petrol pump. The drive points towards the rear of the engine in order to avoid unnecessary bends in the tachometer flexible shaft.

The air screw boss is of standard size, the dimensions being given on the installation drawing.

Provision for priming is made by fitting a distributing ring at the rear of the engine, the ring having small branch pipes leading to each induction pipe. Each branch pipe terminates with a small atomising jet fitted to the induction pipes. The distribution ring is fed by means of a primer pump, filter and T piece, these parts being supplied loose with the engine.

Attached to the rear end of the engine is a conical bearer plate, by means of which the engine is mounted in the airshaft. The accompanying installation drawing gives the principal dimensions, usually required by aircraft constructors.

Specification

Air-cooled Radial Left-hand Tractor.

No. of cylinders	14
Bore	6 in.
Stroke	7·5 in.
Normal B.H.P.	700 at 1,500 r.p.m.
Maximum B.H.P.	777 at 1,650 r.p.m.
Compression ratio	5 to 1.

Weight: Engine complete for installation including bearer plate, propeller boss, dual ignition, carburettor, air intake, and short exhaust pipes, 1,415 lbs.

THE SOUTH AFRICAN SURVEY FLIGHT

THE Big Survey Flight round Africa, commenced on November 17 last, which Sir Alan and Lady Cobham have been carrying out is now almost complete; the Short-Rolls-Royce "Singapore" flying-boat being due at Plymouth today, May 31. It is, however, proposed to extend the flight from Plymouth to include a tour of the big sea ports of this country, in order to show the "Singapore," which has accomplished so much without regularly organised facilities for mooring, refuelling and docking.

No doubt, in a few years' time, liners and yachts of the air will set out on similar voyages from most of these sea ports, so that the visit of this machine should be an historic event.

The African flight has been one of survey for an aerial trade route which shall bring each territory nearer to its neighbours, and provide a means for development and prosperity through a more rapid exchange of passengers, goods and mails. Administration, settlement and commerce will gain tremendously thereby, and now that the conditions for operation are known with some certainty and the requirements of traffic gauged, no time need be lost in establishing the first link in this main trunk route from Egypt into the heart of Africa. A subsidy will be necessary to consolidate the work done and obtain the maximum advantage from experience whilst it is still fresh, but such a subsidy will not be permanent, any more than subsidies have been for other forms of transport in the past. Australia has already been able to reduce her subsidies for air lines, where 5,000 miles are in regular operation over country similarly in need of development, and in the United States, one-third of the air lines are now paying without a subsidy.

In Africa, Sir Alan Cobham has been called the "Flying Ambassador of the British Empire," and the result of his mission, combined with that of his previous flight through Africa, should be the establishment of a permanent British air line, bringing Cape Town eventually within 8 days of London.

Sir Alan Cobham has found all British territories in Africa fully alive to the need for a permanent air line and ready to support the scheme submitted by his company (Cobham-Blackburn Air Lines, Ltd.). But final plans and estimates must receive the support of the Home Government before operations can be commenced. In view of the importance to the Empire of closer personal contact, and bearing in mind that other countries may try to forestall us in the establishment of air lines, there is every reason to take advantage immediately of the enthusiasm created in Africa by this flight.

The total distance covered in the "Singapore" amounts to about 20,000 miles, in addition to which Sir Alan flew over 3,000 miles by D.H. "Moth" light plane in Kenya, Northern and Southern Rhodesia, while the tour round Britain will add another 2,000 miles.

Finally, Lady Cobham's experiences throughout a flight of 20,000 miles, the longest yet made by a woman, must be unique. As a member of the crew, she has had an opportunity of studying from every angle just those points about comfort to which attention must be paid in order to encourage general passenger traffic by air.

The final stages of Sir Alan Cobham's flight may be summarised as follows:—May 25, Las Palmas-Casablanca; May 26, Casablanca-Gibraltar; May 28, Gibraltar-Barcelona. The 650 miles were completed in a gale; May 29, Barcelona-Bordeaux; May 31 (today), Bordeaux-Plymouth.

Subject to re-arrangement, the programme for the tour round Britain will be as follows:—May 31, arrive Plymouth, 12.30 p.m.; June 1, flying over Thames, 1-2 p.m.; arrive Hull 5 p.m. June 4, arrive Newcastle, 11 a.m.; arrive Edinburgh, 5.30 p.m. June 5, arrive Glasgow, 11.30 a.m. June 6, arrive Belfast, 12 noon. June 7, arrive Liverpool 12 noon. June 8, arrive Cardiff, 11.30 a.m. (possibly arrive Southampton 5.30 p.m.). June 9, flying over Thames, 12-12.30 p.m.; arrive Rochester, 1 p.m.

Brigands Rounded up by Aeroplanes

THE leader of a gang of brigands in Iraq, Ghadhban al Kharjiun, after ignoring a demand to surrender dropped from a R.A.F. machine, was successfully "disposed of" and his gang broken up by the combined action of R.A.F. aeroplanes and police forces.

PRIVATE  FLYING

A Section of FLIGHT in the Interests of the Private Owner, Owner-Pilot, and Club Member

A LIGHT 'PLANE MEETING AT ROTTERDAM

FROM a Brirish point of view, it is extremely unfortunate that the dates chosen for the first light 'plane meeting to be held at Rotterdam should clash with a certain aviation event in this country, *i.e.*, with the race for the King's Cup, which is being flown on Friday, July 20, and Saturday, July 21. The dates for the Dutch meeting are July 20, 21, 22, and as it may safely be assumed that practically every light aeroplane in the country will be taking part in the races for the King's Cup and Wakefield Trophy, it is almost certain that no single British machine will be present at the Waalhaven aerodrome. This is very much to be regretted, as the Dutch are our very good friends and one would very much have liked a large British representation at their first light 'plane meeting. We trust that these notes may serve to show that if British participation at Rotterdam is absent, no discourtesy is intended ; the reason will simply be that all our machines will be hard at work on a British two-day's race around Britain.

Organised by the Rotterdam Aero Club, whose address is Veerdam 1, Rotterdam, the International Light 'Plane Meeting will, as already stated, be held on July 20, 21 and 22, at the Waalhaven aerodrome. The Club intends this to be the first of a series of annual meetings to be held at the Waalhaven aerodrome. Our Dutch friends inform us that : " As probably the greater part of the entrants will be members of the different light 'plane clubs, there has been aimed at giving this meeting the same sporting and friendly character that pervades those clubs. Carefully chosen competitions, some most interesting demonstrations and a few entertainments in the evening are hoped to make the time spent in Rotterdam a time they will remember with pleasure."

With previous instances of Dutch hospitality fresh in mind, we feel sure that nothing more delightful than the way foreign visitors will be received could possibly be imagined, and our only regret is that previous engagements will prevent us personally from being present at the meeting.

The first item on the programme will be a " rally," the regulations not being too severe, and it being the intention of the Rotterdam Aero Club to make it serve " to bring competitors to Rotterdam in the right sporting spirit." This aerial " rally " will take place on July 20, and in the evening, after a friendly dinner at the club house of the Royal Yacht Club " De Maas," a special show of the film " Wings " will be given.

On the second day of the meeting, July 21, the main event will be an " Estafette," or, as we should call it, a relay race. After this race, Herr Gerhard Fieseler, the famous German stunt pilot, will given an exhibition of " aerobatics." The afternoon of the second day of the meeting will conclude with the presentation of the Clifford B. Harmon Trophy to Lieut. Koppen in recognition of his magnificent flight from Amsterdam to Batavia and back. In the evening there will be an exhibition of night flying at the aerodrome, with entertainments, fireworks, etc.

Sunday, July 22, will be the most important day of the meeting, and on that day four events are scheduled to take place : A starting competition, an alighting competition, a speed competition, and an altitude competition. At the conclusion of these, Herr Fieseler will once more thrill the spectators with his stunts, after which the meeting will conclude with a dinner.

That the whole affair will be a most charming one there is no doubt. Our good friends the Dutch are most hospitable hosts, and who but a Dutch organiser could possibly have thought of the following little touch ? A Delft ware plate, specially made for the occasion, will be handed to each entrant, for a keepsake.

Rules and Regulations

At first it had been intended to invite all competitors as guests of the Rotterdam Aero Club, but as it was thought that many might prefer to make their own arrangements it was decided to refund to each competitor actually taking part the sum of 75 florins. Fuel and oil will be supplied free to competitors, who are asked to state what brands they prefer. Small repairs will be carried out gratis, the engineers of the club being in attendance at the hangars from July 18 to 25.

The Aerial Rally : Competitors in this will be judged according to the formula $\frac{ST}{D}$ where S is the time, in seconds, after 4 p.m. (" zero hour ") of arrival of the machine ; T is the duration of the flight, in hours, and D the distance flown, in kilometres from point of departure to Waalhaven, the straight-line distance being taken. Competitors select their point of departure, but this must be at least 200 km. (124 miles) from Waalhaven. The winner will be the competitor who scores the *lowest* figure according to the formula. The first prize will be of 125 florins, second 75 florins and third 50 florins. An extra prize of 100 florins will be awarded to the machine covering the longest distance.

The Relay Race : In this, competitors will be divided into groups of three machines, Nos. 1 and 3 flying solo while No. 2 carries a passenger. No. 1 machines of all groups start off together and carry their " Estafettes " over a triangular circuit of 20 km. (12·4 miles). The passenger of No. 2 machine collects the " Estafette " from No. 1 pilot and carries it to his own pilot. They then fly the circuit, and upon landing the passenger of No. 2 machine hands the message to the pilot of No. 3, who flies the circuit with it. The first machine home of the No. 3 groups is the winner. Three first prizes of 50 florins each will be given, and three *objets d'art*.

The Main Competition : The exact regulations for this are not available at the moment, but as already mentioned, it will consist of competitions in taking off, alighting, speed and altitude.

Presumably the objects aimed at will be the shortest possible take-off and landing, and the highest speed over a measured course. In the altitude competition a height of 1,500 metres (4,920 ft.) has to be reached, presumably in the shortest possible time. A total of 220 marks maximum will be awarded in these competitions, divided as follows : Take-off 70 marks ; landing, 60 marks ; speed, 60 marks ; and altitude 30 marks. Four prizes will be awarded as follows : first, 1,000 florins ; second, 500 florins ; third, 300 florins ; and fourth, 200 florins.

The competing machines must conform to the F.A.I. classification of light 'planes, *i.e.*, a maximum tare weight of 400 kg. for two-seaters and 350 kg. for single-seaters. (The programme gives " biplanes " and " monoplanes," but this is obviously an error, probably due to the French expressions *monoplace* and *biplace*).

There is no entrance fee to pay, but entries must be made to the Secretary of the Rotterdam Aero Club, Veerdam 1, Rotterdam, before July 19th, from whom also further particulars can be obtained.

A New Air Scholarship Scheme

IN response to the suggestion put forward by Lady Heath—mentioned in last week's FLIGHT—regarding the establishment of flying scholarships in memory of the first flight from Cape Town to Cairo and England, Sir Charles Wakefield has opened the subscription list with £300.

An American Light 'Plane Meet

THE Milwaukee Light 'Plane Club are organising a " National Baby 'Plane " meeting, to be held at the Cudahy Airport during the last week in August. One of the events will be an " On to Milwaukee " race, while the 50 members of the club are constructing six machines for the meeting.

FLIGHT

LIGHT 'PLANE CLUBS

London Aeroplane Club, Stag Lane, Edgware. Sec., H. E. Perrin, 3, Clifford Street, London, W.1.

Bristol and Wessex Aeroplane Club Filton, Gloucester. Secretary, Capt. C. F. G. Crawford, Filton Aerodrome, Patchway.

Hampshire Aero Club, Hamble, Southampton. Secretary, H. J. Harrington, Hamble, Southampton.

Lancashire Aero Club, Woodford, Lancs. Secretary, C. J. Wood Oakfield, Dukinfield, near Manchester.

Midland Aero Club, Castle Bromwich, Birmingham. Secretary, Maj. Gilbert Dennison, 22, Villa Road, Handsworth, Birmingham.

Newcastle-on-Tyne Aero Club, Cramlington, Northumberland. Secretary, A. H.Bell, c/o The Club.

Norfolk and Norwich Aero Club, Mousehold, Norwich. Manager, F. Gough, The Aerodrome, Mousehold, Norwich.

Nottingham Aero Club, Hucknall, Nottingham, Hon. Secretary, Cecil R. Sands, A.C.A., Imperial Buildings, Victoria Street, Nottingham.

The Scottish Flying Club, 101, St. Vincent Street, Glasgow Secretary, Harry W. Smith.

Southern Aero Club, Shoreham, Sussex. Secretary, C. A. Boucher, Shoreham Aerodrome, Sussex.

Suffolk Aeroplane Club, Ipswich. Secretary, Maj. P. L. Holmes, The Aerodrome, Hadleigh, Suffolk.

Yorkshire Aeroplane Club, Sherburn-in-Elmet, Yorks. Secretary, Lieut.-Col. Walker, The Aerodrome, Sherburn-in-Elmet.

BRISTOL & WESSEX AEROPLANE CLUB

REPORT for week ending May 26.—Total flying hours, 19 hrs. 50 mins.; dual, 11 hrs. 50 mins.; solo, 4 hrs. 45 mins.; passenger flights, 5 flights of 1 hr. 10 mins.

Under instruction (with Mr. Bartlett): Miss Huggett, Messrs. Lynas, Button, Hughes, R. Clarke, T. H. Clarke, Girdlestone, Arnold, Moss, Chopra. Peters, Bathurst. (With Mr. Tratman): Messrs. Button and Stephens.

Arrangements have been made by which two Moths are now available for flying pending the arrival of the new slotted wing machine. Pilot members should therefore note that there is no shortage of machines.

Our machine for the Hampshire Pageant is G-EBTV which flies there on Sunday afternoon.

There is little to report except that the secretary has, at last, bought a new hat, a proof, some say, that the Pageant was a financial success.

CINQUE PORTS FLYING CLUB

REPORT for week ending May 20.—Another well-known pilot, Capt. G. F. Lines of British Airships, Ltd., very kindly came down to give the members instruction over the week-end. He arrived with Mr. Sutton, also of British Airships, Ltd., in an Avro "Avian," and we managed to put in 5 hrs. 15 mins. flying on the two days. Everyone is very grateful to Capt. Lines for his voluntary assistance.

On Sunday, Capt. Neville Stack turned up again in his "Moth," EB-U.F., to visit the club.

A full report is set out below :—

Saturday, May 19 (Moth machine GE-BWC): Total flying time, 2 hrs. 5 mins. Test flight, 5 mins. Dual instruction with Capt. Lines: Mr. Storey, 30 mins.; Lieut.-Comdr. Gubbins, R.N., 30 mins.; Mr. R. Dallas-Brett, 15 mins.; Mr. Douglas, 15 mins.; Mr. Boys, 15 mins.; Mr. Maurice Braddell, 15 mins.

Sunday, May 20: Total flying time, 3 hrs. 15 mins. Mr. R. Dallas Brett, 30 mins.; Mr. Storey, 30 mins; Mr. Maurice Braddell, 45 mins.; Mr. Boys, 30 mins.; Lieut.-Comdr. Gubbins, R.N., 30 mins.; Mr. Douglas, 15 mins.

Joy riding with Capt. Lines and Capt. L. A. R. Braddell, 15 mins.

A Successful Start.—The club officially commenced operations on Friday, the 25th instant, with Maj. L. N. Colin Clarke, D.S.C., as Pilot Instructor. We were fortunate in the weather at the week-end, and managed to put in 16 hrs. 35 mins. (equivalent to about 1,100 miles) in about 4 days, with one machine. Fourteen pupils were under instruction during the week-end, including two lady members.

On Monday evening Maj. Clarke flew Mr. Maurice Braddell, the latest English film star, who is a keen member of the club, from Lympne to Croydon, in the club Moth, to enable him to put in some instruction and to keep his appointment to broadcast from 2 L.O. on Monday night.

During Monday, the club machine was flown over to look at the motor-cycle hill climb at Brook.

There is still a vacancy for additional members, and the capital of the company is not yet fully subscribed. Anyone wishing for particulars should apply to the Hon. Secretary, 114, High Street, Hythe.

REPORT for May 25 to 28, inclusive.—Machine: de H. Moth E.B.W.C. Total flying time, 16 hrs. 35 mins.

Dual Instruction (with Maj. L. N. Colin Clarke): Lieut.-Comdr. Gubbins, R.N., 1 hr.; Mr. Story, 3 hrs.; Mr. Douglas, 2 hrs.; Mr. Edgson Wright, 1 hr. 15 mins.; Capt Took, 30 mins.; Mr. R. Dallas Brett, 1 hr. 20 mins.; Mr. Evernden, 15 mins.; Miss Tagart, 1 hr.; Cmdt. Mary Allen, 1 hr. 30 mins.; Mr. Wood, 30 mins.; Mr. Maurice Braddell, 1 hr. 30 mins.; Mr. Faraday, 30 mins.; Mr. Twaites, 15 mins.; Mr. A. Dallas Brett, 15 mins.

Joy Rides (with Maj. Clarke): Mr. Parks, 45 mins.; Mr. Cunningham, 15 mins.; Mrs. McGowan, 15 mins.; Mr. Bonny, 10 mins.

Test Flights: 20 mins.

LANCASHIRE AERO CLUB

REPORT for week ending May 19.—Flying time, 19 hrs. 15 mins. Instruction, 8 hrs. 40 mins.; solo flights, 5 hrs. 10 mins.; passenger flights, 4 hrs. 35 mins.; tests, 50 mins.

Instruction (with Mr. Baker): Messrs. Gattrill, Chart, Sellers, Benson, Weale, Goss, Miss Baerlein, Messrs. Brooking, Harrison, Mills, Tweedale, Garner, Gort, Secker, Riley, Taylor, W. Hartley, Crosthwaite, Barlow, Stern; (with Mr. Scholes): Messrs. Goss, Riley.

Soloists (under instruction): Messrs. Tweedale, Mills, Stern, Riley.

Pilots: Messrs. Michelson, Hall, Cohen, Crosthwaite, Twemlow, Nelson, M. Meads, Lacayo.

Passengers (with Mr. Meads): Mr. Goss; (with Mr. Twemlow): Messrs. Hall, Allott; (with Mr. Lacayo): Messrs. Thorp, Mills, Fitzgerald, Marsden. (with Mr. Goodfellow): Messrs. F. Scholes, Mills; (with Mr. Cantrill): Mr. Webb, Mrs. Ainsworth, Mr. Caldecott; (with Mr. Gattrill): Mr. Jackson; (with Mr. Baker): Mr. Pinchin.

An excellent first solo by Mr. Riley, counterbalanced by an unfortunate third solo by Mr. Stern. Our "Moth," MQ, is still serviceable!

The aerodrome will be open for flying on Whit Saturday, Sunday and Monday, but will close the following Wednesday and Thursday.

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House Party for Air Guests

AN interesting house party for private owners was given over last week-end at Marsden Manor, Cirencester, by Maj. and Mrs. Fitzgerald. All the 10 guests flew down. They included Mr. and Mrs. Alan Butler, Capt. and Mrs. G. de Havilland, Mr. and Mrs. Nigel Norman, Mr. and Mrs. Muntz, Dr. Whitehead Reid, and Mr. Norman Jones. With the exception of Dr. Whitehead Reid, who flew from Canterbury on his Westland "Widgeon," the other guests mentioned were on D.H. "Moths." They arrived for luncheon on the Saturday, and on the Sunday a picnic by air was enjoyed on Lambourn Downs, where the landing place was marked with an M 5 ft. long, which the guests had to discover just guided with information indicating that it was within the square of a stated area. After 25 minutes Capt. de Havilland discovered the spot first, and the others soon sighted his machine on the ground. On the Monday morning the guests flew back to London in little over an hour.

NEWCASTLE-UPON-TYNE AERO CLUB

REPORT for week ending May 27.—Total flying time, 25 hrs.; instruction, 5 hrs. 25 mins.; solo training, 1 hr. 15 mins.; "A" pilots, 13 hrs. 35 mins.; passengers, 3 hrs. 30 mins.; tests, 1 hr. 5 mins.

Instruction (with Mr. J. D. Parkinson): Mrs. Kish, Miss Klyver, Capt. Lynden Bell, Messrs. Temple, R. G. Lawson, J. M. Kennedy Hayton, V. Heaton, Redshaw, Dr. Alderson.

Solo: Mr. F. Redshaw.

"A" Pilots: Mrs. Heslop, Lieut. Hanney, Messrs. de Pledge, W. B. Ellis, Phillips, Davey, Wilson, Heppell, Runciman, Turnbull, R. N. Thompson, C. Thompson, Robertson, Irving, N. S. Todd, Lloyd Browne, A. Bell, Dr. H. B. L. Dixon, Dr. R. E. Alderson.

Passengers: Mrs. Laing Gibbon, Mrs. Armstrong, Sergt. Graham.

Mr. Wallace, flying his "Moth," G-EBPM, called at the aerodrome on Saturday, en route for Scotland.

Mr. A. H. Bell, who has been secretary of the club since its inception, has resigned to take up an appointment in commercial aviation, and Mr. J. T. Dodds has been appointed secretary.

NORFOLK & NORWICH AERO CLUB

REPORT for week ending May 27.—Total flying time, 18 hrs. 5 mins.

Instruction (with Mr. Young): Messrs. H. P. Clarke, H. Birking, E. Vardon Smith, A. G. Woods, H. Neave, A. A. Rice.

Soloists: Messrs. H. Birkin, E. Lambert, W. P. Cubitt, R. Potter, B. G. Barker, N. Brett, F. Gough, G. F. Surtees, H. Mack, W. A. Ramsay, R. W. Moore. Passengers 18.

Fine weather has set in at last and we hope it will stay. Our "Moth," G-EBQX, has returned from hospital and we feel much more at home. It is surprising how one misses that extra machine.

Great preparations are in hand for the big display on Wednesday, and all we want to make it a big success is fine weather and a big crowd.

Three of our members have been granted "A" licences; they are Messrs. H. Mack, N. Brett, R. F. Potter. We hope to have another batch off shortly.

YORKSHIRE AEROPLANE CLUB

REPORT for week ending May 26.—Flying time, 22 hrs. 25 mins. Instruction, 14 hrs. 45 mins.; soloists, 6 hrs. 40 mins.; passengers, 1 hr.

Instruction (with Capt. Beck): Messrs. Arundel, A. Crowther, H. Crowther, Daly, Fitton, Gill, Harral, Lupton, Little, Ostler, Reynolds, Roberts, A. Senior, G. Senior, Shires, Miss Wilson.

Soloists: Messrs. D. Atcherley, A. Crowther, Dick.

"A" Pilots: Messrs. Ambler, Birch, Clayton, H. Crowther, Ellison, Lister, Thomson, Wood.

"B" Pilot: Mr. Fielden. Passengers: 5.

This week has been more like a week in January from the weather point of view, and consequently somewhat uneventful. We have, however, had a welcome visitor in the shape of Mr. Jock Cameron of the Cornwall Aviation Company, who cast a further gloom over Leeds by trailing an enormous opaque sheet between the sun and the already smoke-darkened city.

FROM THE FLYING SCHOOLS

Henderson Flying School, Brooklands Aerodrome.

REPORT for week ending May 24.—Total flying time, 36 hrs. 5 mins.

Dual (with Col. G. L. P. Henderson): Messrs. Bellville, Carlos, Brooks. (With Capt. H. D. Davis): Messrs. Barclay, Oliver, Saunders, Murray-Philipson, Hamilton, Dr. Wall, Payne, Bennett, Dr. Forsyth, Miss Kidston.

Solo: Messrs. Allen, Barclay, Patton-Bethune, Oliver, Murray-Philipson, Dr. Wall, Hughes, Hamilton.

On Thursday night we passed out Messrs. Allen, Barclay, Patton-Bethune in night flying tests for their "B" licences, at Croydon.

Mr. Hughes has now passed all his tests for his R.A.C. licence.

Several new pupils have arrived and the school is making very rapid progress.

Mr. Murray-Philipson has taken delivery of his "Moth" and was flying hard until dark on Friday, getting used to it.

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AIRISMS FROM THE FOUR WINDS

Mystery of the "Italia"

THE Italian airship, "Italia," with General Nobile and his expedition on board, is missing. It reached the North Pole on the night of May 23 after flying from King's Bay all day since 5 a.m. A cross presented by the Pope before the departure from Italy was dropped and various wireless messages were sent by the ship to Italy for relay through the supply ship and other stations. It should have arrived back at King's Bay by the following Friday or early the next morning at the latest. An early message from General Nobile stated that he was trying to return as quickly as possible. There was sufficient fuel on board for 90 hours' flight. Messages were received from the ship up to Friday morning since when there has been absolute silence. Rumours inferred that a storm had been encountered and one engine had been stopped. Experts in Norway have advanced the theory that in a fog or blinding snowstorm the "Italia" struck one of the high mountains in the north of Spitzbergen. Many authorities are taking active measures for possible relief. The supply ship, "Citta di Milano," set off from King's Bay, passed Amsterdam Island last Sunday, but has since come to a standstill owing to its inability to withstand the vast pressures of the ice. Lieut. Luetzow Holm, a noted Norwegian pilot, left by air for Spitzbergen on May 28 to make a search. Two ships, the "Hobby" and the "Braganza," were expected at Spitzbergen shortly carrying a detachment of Norwegian soldiers who are used to Polar conditions. They will search north of Spitzbergen. Capt. Riiser Larsen was also reported to be leaving Norway with aeroplanes. It appears that the position of the ship when last heard from was about 175 miles from its base in a north-easterly direction between Moffen Island and North-East Island. The crew on board numbered about seventeen.

Great Flying-Boat Cruise

THE four R.A.F. Supermarine-Napier "Southampton" flying-boats, which are continuing their big cruise to Australia, have arrived at Bima (Sumbawa, Dutch East Indies).

Air Minister's Channel Cruise

SIR SAMUEL HOARE left Calshot on May 29 in the Short "Calcutta" flying-boat to carry out a cruise embracing the Channel Islands, Cattewater, Plymouth, and the Scilly Isles. The return flight was to be via Cattewater again and on to Calshot. On board with the Air Minister were Lady Maud Hoare, Air Vice-Marshal Sir John Higgins and Lady Higgins, and Mr. Geoffrey Lloyd, the private secretary to the Minister. A Supermarine "Southampton" flying boat accompanied the Short "Calcutta" as escort. About 700 miles were to be covered in two days. The "Calcutta" is shortly to be handed over to Imperial Airways for operation, first on the Southampton-Channel Islands route, and ultimately on a section of the Imperial air line between London and Delhi. It is of all-metal construction and carries fifteen passengers, whilst the engines are three Bristol "Jupiters" of 450 h.p. each. On page 397 will be found illustrations of the Air Minister's departure from Calshot.

The Italian Seaplane Cruise

THE Italian flight of over sixty seaplanes, under the command of Gen. de Pinedo, left Orbetello early on May 26, and flew to Elmas, Sardinia. On May 28 the air fleet arrived at Los Alcazares, Cartagena, from Pollensa, Majorca, where it had arrived the day previously. The fleet is made up of a squadron of S.55 twin "boat" tandem engined monoplanes, and five squadrons of S.59 single-engined biplane flying-boats.

Costes and Le Brix

THE two French World Flyers, Capt. Costes and Lieut. L. Brix, who are making an aerial tour round Europe on their Breguet 19, "Nungesser et Coli," flew from Bucharest to Belgrade on May 23, and the following day they arrived at Warsaw. On May 26, Prague was reached, and the next day, escorted by about 50 military aeroplanes they arrived at Strasbourg, where they met with a great reception.

New York-Rome Flight Preparations

SIG. SABELLI'S Bellanca sesquiplan on which he intends to attempt a flight from New York to Rome, was flown from Hadley Field, N.J., to Roosevelt Field, Long Island, on May 25. Fuel and load tests will now be carried out, after which the Atlantic attempt will be made, but when and from where, has not been disclosed.

Mexican Flight to U.S.

CAPT. CARRANZO, the Mexican airman who made a non-stop flight from San Diego to Mexico City recently, now proposes to attempt a non-stop flight from Mexico City to Washington, thus returning Col. Lindbergh's visit.

By Airship to Australia

ACCORDING to the *Daily Mail*, an attempt to fly from England to Australia is to be made at the end of July in a semi-rigid airship being secretly constructed at the works of C. G. Spencer and Sons, Ltd., of Highbury, N., for Mr. Bert Campbell, an Australian.

Atlantic Airship Race

STRENUOUS efforts are being made to be the first to carry out the demonstration flights across the Atlantic by passenger-carrying airship, on the one hand by Britain with R.100, and on the other hand by Germany with the L.Z.127. Both ships are said to be nearing completion and expected to make trial flights next July.

New Belgian Congo Air Line

GEN. TILKENS, Governor of the Belgian Congo opened a new air line from Leopoldville to Coquilhatville via Bandundu and Ulongo, making the first flight over the route.

Prince of Wales Flies to Sandringham

THE Prince of Wales made his first trip on May 27 in the Bristol biplane which, as previously recorded in FLIGHT, has been set aside for his special use. He flew from Scarborough to Sandringham, and was piloted by Flight-Lieut. Don.

An Air Transport Company for Uruguay

THE Uruguay National Council of Administration has granted a charter for the formation of a new company, known as the Aero Porta Uruguay, which will operate aerial passenger, mail and freight services in that country.

A New U.S. Air Transport Company

THE Commercial Air Transport, Inc., was recently formed in Rochester, N.Y., with Edward J. Doyle as president. This company will operate Commercial Airport, an aerodrome of 50 acres situated 5 miles west of Rochester, and will have machines always available for express and passenger services to all parts of the country. They will also act as agents for the Challenger aeroplanes, manufactured by the Kreider-Reisner company of Hagerstown, Md.

German Air Line Fatality

ON May 27 a Lufthansa Junkers on the Dortmund-Frankfurt line crashed shortly after leaving Dortmund, the pilot and two of the four passengers being killed.

French Air Liner Crashes

A FARMAN-JUPITER Goliath air liner on the Paris-Cologne-Berlin service crashed on May 23 shortly after leaving Cologne for Berlin, and caught fire. The pilot, Charpentier, the mechanic, and a woman passenger were killed.

Twenty Years Ago!

Extract from "The Auto." (Precursor of "Flight"), May 30, 1908.

"*Mr. Henry Farman and M. Delagrange.*—Both Mr. Farman and M. Delagrange are exploiting likely fields for their flying demonstrations outside Paris. The former on Tuesday made a 300-m. flight at Grand before the local notabilities prior to a Flying Competition on Wednesday. M. Delagrange has been giving some short flights at Rome, and on Monday some of the crowd indulged in rather rough horseplay when, owing to weather, the aviator declined to take to the air. On Tuesday, however, by making a flight of 2 kms., he more than redeemed his position."

FLIGHT

THE ROYAL AIR FORCE

London Gazette, May 22, 1928.

General Duties Branch

The follg. Pilot Officers on probation are confirmed in rank :—P. D. Cracroft (April 5) ; M. Fountain-Barber (April 12). Pilot Officer on probation, R. A. E. Birch, resigns his short service commn. (May 19). The short service commn. of Pilot Officer on probation, P. H. E. Grisewood, is terminated on cessation of duty (May 9).

Medical Branch

The follg. are granted short service commns. in rank of Flying Officer for three years on Active List, with effect from and with seniority of, May 2 :—J. H. Cullinan, T. A. Edwards, A. R. French, P. J. Nyhan, M.B., B. A. Porritt, M.B.

Flight-Lt. (Hon. Squadron Leader) F. W. Squair, M.B., Ch.B., relinquishes his tempy. Commn. on completion of service, and is permitted to retain the honorary rank of Squadron Leader (May 16).

RESERVE OF AIR FORCE OFFICERS

General Duties Branch

The follg. are granted commns. in Class A in the ranks stated (May 22) :—Flying Officer.—J. R. Cox. Flying Officers on Probation.—C. Byron, W. E. Hall, A. W. Simon.

Flying Officer A. J. Stubbings relinquishes his commn. on completion of service (March 31) ; Flying Officer G. H. Winckworth is transferred from Class B to Class C (May 18). The follg. officers resign their commns. :—Flight Lt. J. F. Stallard (Jan. 24) ; Flying Officer A. R. Latham (April 3). Flying Officer H. A. Hince relinquishes his commn. on account of ill-health, and is permitted to retain his rank (May 23).

Princess Mary's R.A.F. Nursing Service

Sister (Acting Matron) Miss J. MacLeod, A.R.R.C., resigns her appointment (April 24).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the R.A.F. are notified :—

General Duties Branch

Wing Commander T. E. B. Howe, A.F.C., to R.A.F. Station, Northolt, to command, 15.5.28.

Squadron Leaders : A. H. Peck, D.S.O., M.C., to No. 55 Sqdn., Iraq, 25.4.28. J. J. Breen, to Armoured Car Wing, Iraq, 9.4.28.

Flight Lieutenants : E. S. Borthwick-Clarke, to H.Q., Aden Command, 4.5.28. V. P. Feather, to Home Aircraft Depot, Henlow, 7.5.28. J. R. Wolley and C. W. Weedon, to R.A.F. Depot, Uxbridge, 6.4.28. F. W. Sinclair, D.F.C., to R.A.F. Depot, Uxbridge, 31.3.28. O. R. Gayford, D.F.C., to Station H.Q., Heliopolis, 10.5.28. H. L. P. Lester, to No. 14 Sqdn. Amman, 1.5.28. W. G. L. Montagu-Douglas-Scott, to H.Q., Iraq, 11.5.28.

Flying Officers : A. N. Francombe, to Aircraft Park, India, 9.4.28. R. A. Barnett, to Aircraft Depot, India, instead of to No. 31 Sqdn., as previously notified, 23.3.28. J. C. Cunningham, to Aircraft Depot, India, instead of to No. 20 Sqdn., as previously notified, 23.3.28. D. C. Burnley and C. N. A. B. Mumby, to R.A.F. Depot, Uxbridge, 6.4.28. C. F. Steventon, to R.A.F. Depot, Uxbridge, 13.4.28. J. H. Woodin, to H.Q., Middle East, 10.5.28. W. E. Gray, to Station H.Q., Heliopolis, 16.4.28.

Pilot Officers : J. F. Griffiths, to Aircraft Depot, India, instead of to No. 28 Sqdn., as previously notified, 23.3.28. J. Addison, D. A. L. Campbell, H. H. Chapman, P. L. M. C. Deacon, J. W. Hawke, F. R. Jones, W. H. Jones, H. Kerr, H. D. McGregor, G. F. MacPherson, R. G. Whalley, E. S. Whitaker, H. J. A. Williams, F. R. Balfour, C. G. Davies, E. L. Johnstone, and M. N. Oxford, to No. 3 Flying Training School, Grantham, 30.4.28. I. McL. Cameron and J. H. Lindell, to No. 7 Sqdn., Worthy Down, 2.5.28. C. R. Clarke and G. E. Klein, to No. 10 Sqdn., Upper Heyford, 2.5.28. J. F. McKenna, to No. 99 Sqdn., Upper Hyeford, 2.5.28. D. T. Saville, to No. 17 Sqdn., Upavon, 2.5.28.

Stores Branch

Wing Commander W. J. Shields, to No. 1 Stores Depot, Kidbrooke, 7.5.28.

Flight Lieutenant P. J. Murphy, to R.A.F. Depot, Uxbridge, 31.3.28.

Flying Officers : R. G. A. Vallance, to No. 2 Wing H.Q., India, 3.4.28. J. H. P. Clarke and F. A. R. Smith, to R.A.F. Depot, Uxbridge, 6.4.28.

Accountant Branch

Flight Lieutenants : J. Sullivan, to Home Aircraft Depot, Henlow, 10.5.28. W. W. Deane, to R.A.F. Station, Tangmere, 22.5.28.

Medical Branch

Flight Lieutenant G. S. Strachan, M.B., to No. 28 Sqdn., India, instead of to H.Q., India, as previously notified, 13.4.28.

Medical Branch

Flight Lieutenant G. P. O'Connell, M.B., to R.A.F. Depot, Uxbridge, 6.4.28.

Flight Lieutenant (Q.Mstr. Medical) J. M. Maxwell, to R.A.F. Depot, Uxbridge, 31.3.28.

Flight-Lieutenant (Dental) P. P. Hogan, to H.Q., Middle East, 30.3.28.

Flight Lieutenants : B. F. Haythornthwaite, M.B., B.A., to R.A.F. Depot, Uxbridge, 6.5.28. L. C. Palmer-Jones, M.B., to Station H.Q., Heliopolis, 1.4.28. G. J. S. O'Malley, to No. 208 Sqdn., Middle East, 9.4.28. B. L. Edwards, M.B., to R.A.F. General Hospital, Iraq., 13.4.29. L. I. Hyder, to R.A.F. Combined Hospital, Iraq, 12.4.28.

Flying Officers : J. J. Quinlan, M.B., to R.A.F. Station, Donibristle, 15.5.28. J. H. Cullinan, T. A. Edwards, M.B., A. R. French, P. J. Nyhan, M.B., and B. A. Porritt, M.B., to Medical Training Depot, Halton, on appointment to short service commns., 2.5.28. J. E. Foran, M.B., to No. 8 Sqdn., Aden, 1.5.28.

SASSOON CUP RACE

ONCE again the Fighter Squadron met on May 24, to have their annual " battle " for the Sassoon Cup.

This year the race started from Sutton's Farm (re-named Hornchurch Aerodrome) and the contest was over a two laps' course—total 101 miles—Hornchurch, Leigh, Chelmsford and back, and was won by F./O. H. T. Andrews (Siskin Jaguar) No. 41 Squadron, Northolt, in 42 min. 26 secs., average speed, 134½ m.p.h.

The competitors had to keep above 1,000 ft., except at the finish when they were allowed to dive down over the finishing line.

At each turning point a Lynx Avro patrolled at 900 ft. to keep a check on machines as they turned.

The race was timed to start at 15 hrs. 30 mins., and all machines looking very clean and bright were lined up, head into wind at right angles to the enclosures, one machine from each squadron :—

Pilot	Squadron No.	Machine.
F./O. P. R. Barwell	19	Siskin-Jaguar IV.
P./O. R. A. Stowell	32	,,
P./Serg. W. Kerswell	111	,,
Sq./Ldr. E. O. Grenfell ..	1	,,
F./O. C. W. Thompson ..	43	Gamecock-Jupiter.
Flt./Lt. H. C. Calvey	23	,,
Flt./Lt. W. Swann	25	Grebe-Jaguar.
P./Serg. T. W. Morton ..	29	Siskin-Jaguar.
F./O. D. J. McMillan	3	Woodcock-Jupiter.
P./O. P. McG. Watt	17	,,
Flt./Lt. W. N. Plenderleith ..	56	Siskin-Jaguar.
F./O. H. T. Andrews	41	,,

In order to avoid the possibility of overcrowding at corners and the consequent danger attached, the " field " was divided into two heats with an interval of five minutes between, so as to avoid taking up too much time.

There was no final, but the first machine home of each heat that did the fastest time under handicap was declared the winner.

From a spectators' viewpoint it was not a race, but merely a follow-my-leader procession of aeroplanes that followed one another at intervals, round the sky !

The Siskins led off, followed by Woodcocks, one Grebe and the two Gamecocks scratch.

One Woodcock feeling apparently in want of a little excitement, came round at about 400 ft., this was too much for the Avro on patrol, which suddenly gave up hanging on sky-hooks, with the result that the Woodcock was disqualified.

One Siskin failed to return, having fallen by the wayside.

There was none of the excitement of last year's event, in fact it could not be called a race, owing partly to the handicapping, no final, and that both the Siskins and Gamecocks had their throttle controls sealed to prevent the pilots " going through the Gate."

The fastest laps and total time were done by the Gamecocks and Grebe, the former being last year's winning machine. F./Lt. Calvey, in spite of his throttle being sealed, put up a very fine effort but the handicapping was against him :—

No.			Min.	Sec.	Aver.
23	F./Lt. Calvey	Gamecock ..	38	06	150
25	F./Lt. Swann	Grebe ..	39	28	—
43	F./O. Thompson ..	Gamecock ..	39	30	—
41	F./O. H. T. Andrews ..	Siskin ..	42	26	134½
1	Sq./Ldr. Grenfell	,, ..	42	29	—
111	Sgt. Kerswell	,, ..	42	37	—

Compared with last year's winner's average of 156 m.p.h. (Gamecock), this year's 134½ m.p.h. average is very poor, even when taking into consideration that the machines were fitted with supercharged engines and designed for speed at height.

No. 111 Squadron are to be congratulated on the excellent arrangements both as regards enclosures, car park and excellent tea provided in the officers' mess after.

Owing to the difficulty of getting out to Hornchurch there were comparatively few spectators, whereas had it been held at Hendon, the general public would have had a better chance of getting there.

There were comparatively few service people present except those directly interested in the event, which seemed rather a pity as a race of this sort should bring representatives from all squadrons.

AIR MINISTRY NOTICES

Titles of Officers in Charge of Croydon and Lympne Civil Aerodromes

THE titles of the officers in charge of the Government Civil Aerodromes at Croydon and Lympne have recently been revised, and are now as follows :—The Chief Aerodrome Officer, Croydon Aerodrome, Croydon, Surrey; the Aerodrome Officer in charge, Lympne Aerodrome, near Hythe, Kent.

(No. 40 of 1928.)

Belgium : Brussels (Haren) Aerodrome Regulations

1. *Regulations for departure of aircraft.*

When an aircraft is ready to depart from Brussels (Haren) aerodrome, a "Contrôle" form, together with the usual documents, is handed to the pilot by the aerodrome official responsible for the collection of charges incurred.

This form, duly completed and bearing the signatures of the competent aerodrome officials, is handed by the departing pilot or the representative of his company, to the embarkation area official. The latter will then signal with a green flag to the control tower.

Permission for the aircraft's departure will be given from the control tower by the operation of the signal light or the siren*, and by the uncovering of a signal panel denoting the ownership of the aircraft to which the signal refers. Seven panels are installed, of varying colours, indicating certain different air transport companies. The panel of Imperial Airways, Ltd., is violet, and that for private individuals, and companies without specially allocated panels is blue and white check. A red panel indicates that taking-off is prohibited.

All departing aircraft must proceed *via* the embarkation area, with the exception of aircraft undergoing test by the S.A.B.C.A. (aircraft constructors). This company will display a white flag near the aircraft which it proposes to test in flight, and permission to take-off will be given by exhibiting the blue and white check panel.

When an aircraft is taxi-ing into position to take-off, the signal panel will be re-covered.

In the event of an error in the signalling from the embarkation area or the control tower, the brisk waving of a red flag will indicate that the preceding signal is cancelled.

2. Zero Wind Regulations

When the velocity of the wind is less than 1 metre per second, a ball 1·5 metres in diameter and painted with alternate red and white stripes, is displayed from a signal mast, which is 12 metres high, painted with alternate red and white bands, and situated opposite the right wing of the traffic office on the N.E. side of the aerodrome. When this ball is exhibited, a landing T will be displayed within a white crown, which is permanently marked on the platform adjoining the signal mast. Aircraft must then take-off and land in conformity with the T.

(No. 41 of 1928.)

* One blast of 10 seconds' duration announces the departure, and 2 blasts the arrival of aircraft.

R.AE.S. AND INST.AE.E.

Official Notice.

Lecture by Lieut. R. R. Bentley.—Lieut. R. R. Bentley, M.C., A.F.C., S.A.A.F., will lecture before the Royal Aeronautical Society on Friday, June 1, at 6.30 p.m., at the Royal Society of Arts, 18, John Street, Adelphi W.C. 2.

Arctic Flight by Captain G. H. Wilkins.—A lecture will be given by Captain G. H. Wilkins before the Royal Aeronautical Society at the Royal Society of Arts, 18, John Street, Adelphi, on Thursday, June 14, 1928, at 6.30 p.m. Captain G. H. Wilkins and Lieut. Carl B. Eilson left Point Barrow, Alaska, on April 15, and flew 2,200 miles above the Arctic Circle to Green Harbour, Spitzbergen in about 21 hours' flying time. The machine used was a Lockhead Vega monoplane fitted with a 220 h.p. Wright Whirlwind engine.

In the course of his lecture Captain Wilkins will reveal many interesting and valuable particulars and details of his flight, which was accomplished under difficult conditions. The greater part of the flight was made over regions which have never been explored, over the so-called "blind-spot" of the Arctic, in the hopes of finding hitherto undiscovered land.

Admission to the lecture is free or by ticket on application to

J. LAURENCE PRITCHARD, *Secretary*

PERSONALS

Married

FLIGHT-LIEUTENANT ARCHIBALD HAROLD GOLDIE, R.A.F., son of the late Archibald Watson Goldie and Mrs. E. M. Goldie, of Teddington, Middlesex, was married on May 12, at Totnes, to SYLVIA MARY ALEXANDER, only daughter of Mr. and Mrs. J. J. Alexander, of Upton, Paignton.

ROBERT GEDDES SPENCE, D.F.C., younger son of Mr. and Mrs. W. G. Spence, Woodside, Sunderland, was married, on May 16, at St. Michael and St. Martin's Church, Eastleach, to SUSANNAH, elder daughter of Mr. and Mrs. G. W. WHITE, Fyfield Manor, Lechlade.

To be Married

An engagement is announced between FLIGHT-LIEUT. HERBERT N. HAMPTON, D.F.C., R.A.F., elder son of Mr. and Mrs. S. T. Hampton, of Bishop's Stortford, and MISS MARJORIE BODIMEADE, elder daughter of Mr. and Mrs. F. E. Bodimede, of Kenton, Harrow.

The engagement is announced, and the marriage will shortly take place, between JOHN HORTON WOODIN, R.A.F., elder son of the Rev. Stanley H. Woodin, M.A., and Mrs. Woodin, of Yarmouth Rectory, Isle of Wight, and JOYCE MARY BYGOTT, of 26, Sussex Mansions, S.W., widow of H. C. Bygott.

R.M. Groves Memorial Prize Essay Awards

THE awards in the 1927 competition for the R. M. Groves Memorial Prizes, which are open to all members of the Royal Air Force, for an essay on "Forecast of Air Development," are as follows :—*1st prize*, Wing Commander W. S. Douglas, M.C., D.F.C., Fighting Area, Air Defence of Great Britain. *2nd prize*, Flight-Lieut. H. P. Lloyd, M.C., D.F.C., Headquarters, No. 23 Group, Inland Area. *3rd prize*, Flight-Lieut. W. M. Yool, Fighting Area, Air Defence of Great Britain. *Special prize*, Sqdn.-Ldr. P. B. Hunter, No. 1 School of Technical Training (Apprentices), Halton.

The Memorial Essay prizes were established by the family of the late Air Commodore R. M. Groves, C.B.E., D.S.O., R.A.F.

Air Ministry Sports

THE Air Ministry Athletic Association held its sixth annual sports meeting at Herne Hill on May 17, when a lively programme for both sexes was carried through. The results produced no change in the men's championships as regards the title holders. The 100 yards was retained by A. W. Savage, the Blackheath Harrier, and B. C. Oddie retained the Air Ministry A.A. Challenge Cup by winning the mile in 4 mins. 34⅘ secs. The Halahan Challenge Shield for the tug-of-war was held by the Director of Equipment's team. On the other hand, Miss A. F. Chapman, the holder of the ladies' 100 yards championship was beaten by Miss G. L. Hardman.

PUBLICATIONS RECEIVED

Technical Notes : No. 271.—Full-Scale Drag Tests on Various Parts of Sperry Messenger Airplane. By Fred E. Weick. January, 1928. *No.* 272.—Special Propeller Protractor. By A. L. Heim. January, 1928. *No.* 273.—Helium Tables. By Lieut.-Comdr. C. H. Havill, U.S.N. January, 1928. The National Advisory Committee for Aeronautics, Washington, D.C., U.S.A.

Light Metals and Alloys : Aluminium ; Magnesium. Bureau of Standards, Circular No. 346. Department of Commerce, Bureau of Standards, Washington, D.C., U.S.A.

Interplanetary News, Thoughts, Legends and First Phantasies. By N. A. Rynin. Co-operative Society "Petchatnia," Leningrad.

Aeronautical Research Committee Reports and Memoranda : No. 1111 (*Ae.* 285).—A General Theory of the Autogyro. By H. Clauert, M.A. November, 1926. Price 1*s.* 6*d.* net. *No.* 1117 (*Ae.* 290.) Scale Effect on Three Aerofoils at Low Values of LV, R.A.F.32, Göttingen 433, and Göttingen 410 with 2 Per Cent. Centre Line Chamber. By F. B. Bradfield. August, 1927. Price 6*d.* net. H.M. Stationery Office, Kingsway, London, W.C.2.

Report on the Royal Air Force Promotion Examinations "B" and "C," held on 14th, 15th, 16th, and 17th September, 1927. (*Air Publication* 1307). H.M. Stationery Office, Kingsway, London, W.C.2. Price 1*s.* net.

The Royal Air Force Memorial Fund : Eighth Report, for the Period January 1 to December 31, 1927. The Royal Air Force Memorial Fund, 7, Iddesleigh House, Caxton Street, Westminster, S.W.1.

Airships To-day. British Airships, Ltd., 21, Northumberland Avenue, London, W.C.2.

The National Physical Laboratory Report for the year 1927. *Department of Scientific and Industrial Research.* H.M. Stationery Office, Kingsway, London, W.C.2. Price 7*s.* 6*d.* net.

The Medical Examination of Civilian Aviators. C.A Publication 1. *Second Edition. January,* 1928. H.M. Stationery Office, Kingsway, London, W.C.2. Price 1*s.* net.

Die Luftversicherung, Entwicklung, Recht und Technik. By Dr. jur. Hermann Doring. Deutscher Verein für Versicherungs-Wissenschaff, Landshuter Strasse 26, Berlin W.30.

How to Drive a Car : The Niceties of Control. By the Editor of "The Motor." Temple Press, Ltd., 5-15, Rosebery Avenue, London, E.C.1. Price 2*s.* 6*d.* net.

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AERONAUTICAL PATENT SPECIFICATIONS

(*Abbreviations :* Cyl. = cylinder ; i.c. = internal combustion ; m. = motor. The numbers in brackets are those under which the Specifications will be printed and abridged, etc.)

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